RESULTS & DISCUSSION

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Experiment I

Growth Behaviour of *Scindapsus aureus, Philodendron scandens, P. bipinnatifidum,* and *P. erubescens*.

Before discussing the growth behaviour of the four tested species , it must be mentioned the following general observations:

(1) The four species seem exhibit complete apical dominance phenomenon as main stem grows continuously without any lateral branch formation.

(2) The removal of apical bud stimulates the growth activity of only one axileary bud, that the most nearest one to the apical portion, of the fourth tested species.

(3) The main stem nodes are used as common stem cutting for vegetative propagation by mean of one node leafy cuttings. The higher the number of nodes and leaves formation, the higher stem cuttings are gained, and that depends on the seasonal fluctuation of the growth activities which were controlled by the prevailing environmental factors, as the plant growth is an expression to the external and internal factors. The tested four species are considered as tropical and sub- tropical plants. Accordingly, the vegetative propagation of the examined plants depends upon their growth activity.

(4) The flowering was completely absent under the cultivation conditions in Egypt of the four tested species.

(5) The available previous knowledge about the morphological criteria of the four tested species were very rare, thus the study were extended to the description of such criteria.

(A) General observations :

1) ***Scindapsus aureus, Engler; Pothos aureus; Epipremnum aureum*** **(Devil'sivy)** known commercially as ***"pothos"***.

This species could be grown by three methods under decorated conditions :1) as vine vertical climbing when stands on support, 2) as pending when plants are grown under hanging pots; 3) or grows horizontally like the creeping or running plants. These three types of growth: climbing, hanging pendulous or horizontal forms were tested by the authoress.

The growth behaviour, plant shape, development and morphological structure seemed to be more or lees change under the three types of growing methods.

This species is a tall fleshy vine climbing by rootlets when grows erect by stand on support. The climber rootlets are formed in large numbers on the internodes of the only opposite side to the support. Such rootlets are very small in size, their lenght about 1-5 mm., with 1-2 mm. in thickness. Another type of a few numbers of roots (about one to three) may by developed from the nodes. This type of aerial roots appears to be taller than the climber rootlets in developing stage, as this type of roots appears to be as scar during the juvenil stage (see photo.2). This scar noded arial roots are developed into functional roots under vegetative propagation of one node leafy soft juvenil stem cutting. Thus, it was suggested that the roots which be formed and developed from the nodes are more functional roots and we define them as "noded aerial functional roots", while the climber ones as "aerial climber internoded rootlets". It must be mentioned that the two types of roots seemed to be more or less in their least amounts under pending of hanging pot conditions under this investigation conditions. However, the two types of aerial roots were formed and developed under the horizontal growth method-conditions, with a few numbers of aerial climber internodded rootlets. In addition, under climbing growth method, heavy formation of aerial climber internoded rootlets were developed to a certain extent. We thought that external conditions may affect endogenous change(s) whiching lead to the formation and development of every type of the aerial roots, as the formation and development of every type of aerial roots were greatly variable under different conditions of the three tested growing methods. It was suggested that, more work must be carried out if the question is to be fully answered in this connection.

Stems are fine sulcate between nodes (internodes are not smooth). Such fine sulcate texture was obvious and more clear when "Pothos" plant was grown erect by stand supports (climbing conditions), or under horizontal growing method conditions. However, such Sulcus texure was in lesser evidence when stem growing under pending condition or in juvenile stem portions. The stem thickness was in its lowest value at the base or at juvenil stage (about 0.5 cm) but may be developed into more thickness (about 2.5 cm) in the

oldest stem portion (except the basal stem portion). This phenomenon was clear under the three growing methods. However, stem was more fleshy under pending or creeping conditions with less thickness than that growing under climbing conditions.

Leaves are waxy and pale to dark green with yellow or white yellowish variegation (see photos, 4). The proportions of green to white yellowish variegation islands are greatly differ from one leaf to another on the same plant without no clear correlation with the method of growing plants. However, there were some correlations between the leaf. Position and the variegation islands, as the basel leaves seemed to possess higher green islands than the later formed apical ones (see photos, 3 a&b). The variegation proportion may be responsed to the kind of light and its intensity **(Grof, 1986).** Accordingly, as this species is used as indoor decorated plant, variable variegation is obtained under the great variable users room light conditions

The shapes of the leaves are greatly varied from ovate to ovate - oblong or broad ovate (photos. 4- a, b, c, d&e), more or less cordate at base, 8-12 cm. long when plants grew under pending or creeping conditions, while mature leaves may be reached into 60 cm. long or more under climbing and supporting conditions with the least variegation shape. It was observed that the upper leaf blades of whole plant were always arranged in one side direction under the three growing methods { see photos. (3 , a& b and 4)}.

It was observed that if the juvenile and young plants were subjected to a definited specific position under room conditions with the variable direction of relative higher light intensity, the new successive developing leaf blades were directed and arranged their upper surface to a definite one direction position, while both types of roots are to oposite one. If this specific position was changed the old leaf blades fail to regulate their upper surface leaf blades situation position to the new subjection conditions and finally these old leaves were died completely. This condition may be partially explained why "Pothas" plants could not be servived after translocation from one place to another without care to the direction of leaf blades, as whole plant leaf blades, adapt their situation patern to a definite position in relation to their serrounding environmental conditions specially the light source direction, as well as gravity and/or supported materials i.e. the sensous agents. Accordingly, it may be

recommended that care must be taken in consideration in the change of "Pothos" plants from place to another to pot leaf blades upper surface in the correct position with the light direction. The one sided arrangement of upper leaf blades was clear under the three growing methods; i.e. erect climbing, creeping horizontal, and pending conditions.

From the above mentioned observation and the recorded photographes, it may be concluded that the great variations in "Pothos" growth behaviour under the three growing methods seemed to be related to the high sensitivity of its organ to many external factors such as relative high light intensity direction, gravity and/or the different bodies adjacent to the plant organs, supporting, stands pole materials for example. It was considered this sensitivity as a type of nastic movements or nutation, otherwise nyctinasty and the tropism may be interplay in this connection. As the nastic movements direction is determined by the morphology of the plant organs and the stimular agent position **(Devlin & Witham, 1983),** it was considered the one side direction of leaf blade under the three growing method with the alternation of two root types situation as a type of nastic movement. It was considered that at least three types of stimulus agent affected this phenomenon in "Pothos" plant, the direction of light, the gravity, and the adjacent bodies. Epinasty or hyponasty movements may play an important role in this connection as the bending observations in leaf petiols and stems were clear under the three growing methods. Tropism may interplay in this connection. Whatever the terminology and the cause of "Pothos" growth behaviour under pending, creeping or climbing condition the mechanism of this phenomenon seems to be controlled by the variance bending of stem, leaf petiole and or leaf blade during early periods of their developments with the correlation to external stimulus agents. The direction of such nastic movements or tropism is based on the physiological state of tissue organ and the spatial relationship between the stimulus and the responding plant part **(Devlin & Witham 1983).** It was supposed that much work must be done in this respect if the question is to be fully answered.

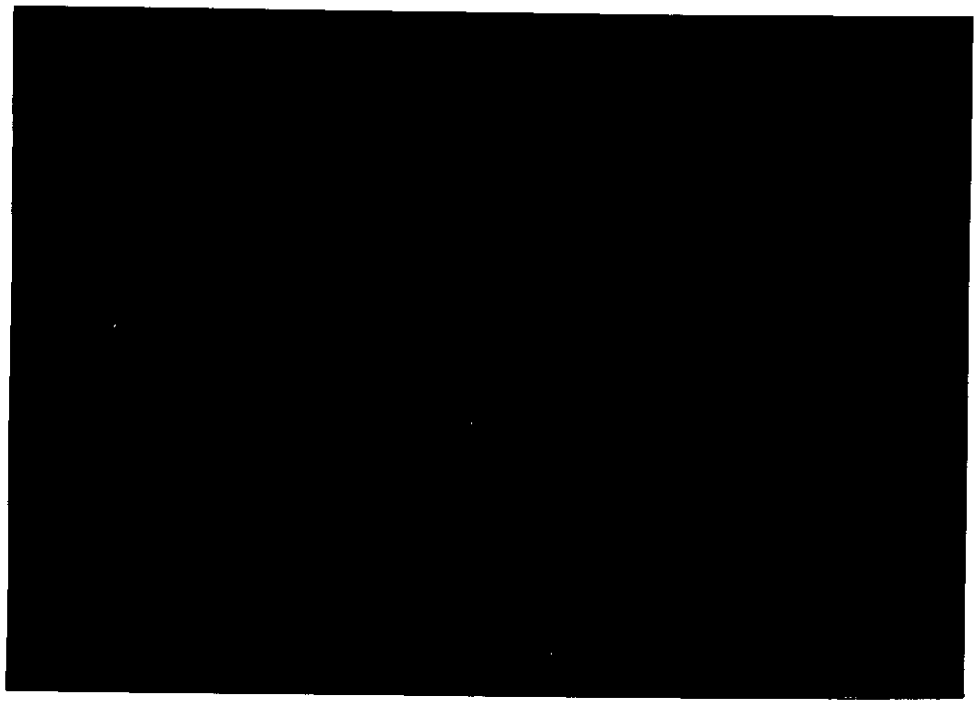


Photo.(2): Show part of "Pothos" stem grew under creeping method conditions. The following parts and phenomena could be observed: (*2.5).

a) The two types of developing aerial roots, i.e the noded more obvious developing aerial roots, and lesser developing "internoded climber rootlets" are very clear.
b) The root scors of both root types which appear as dark brown spots either on node or internode portion are very clear.
c) The bending of the stem either into-upward or-downward direction is clear. The function of this bending seems to control the direction position of leaves and roots, as leaf petioles direction is always shown upward, while both types of aerial roots direction is always on the opposite side down ward.

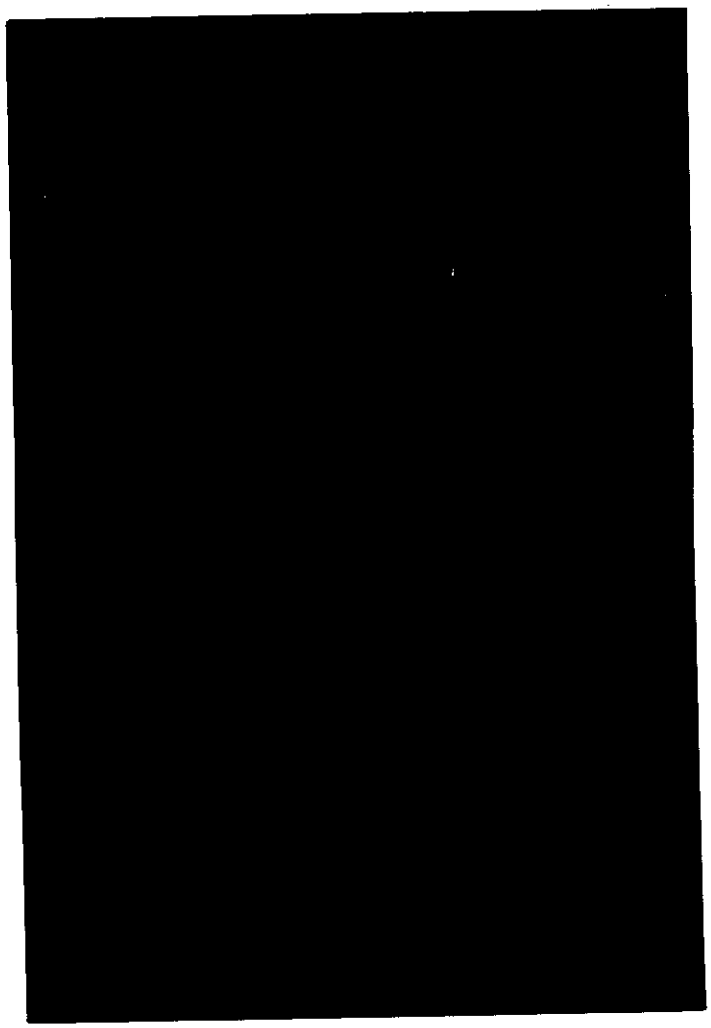


Photo. (3,a)

Photo. (3):(a &b *0.5).

Juvenile apical "Pothos" plant portion grew erect under climbing conditions as (a) supported with glass rad pole, (b) Supported to room wall by very small and thin stickers; both were subjected in front of window under room conditions, i.e. exposed to one side direction of relatively higher indirect light source intensity. The following observation could be detected.

(I) The development of whole plant upper leaf blade surfaces are shown in one side direction in front of relative higher indirect light intensity direction. We suppose that stem leaf petioles and leaf primordia are very sensitive to the light direction, and stem and petiole are responsed to such phenomenon; as great variables of bending directions of such organs are observed. We also supose that light intensity direction is the main stimulus agent for such bending condition and hence the arrangement of leaf blades in one direction.

(II) The greater variegation shape of upper leaf blades is clear than that of other lower oldest ones.

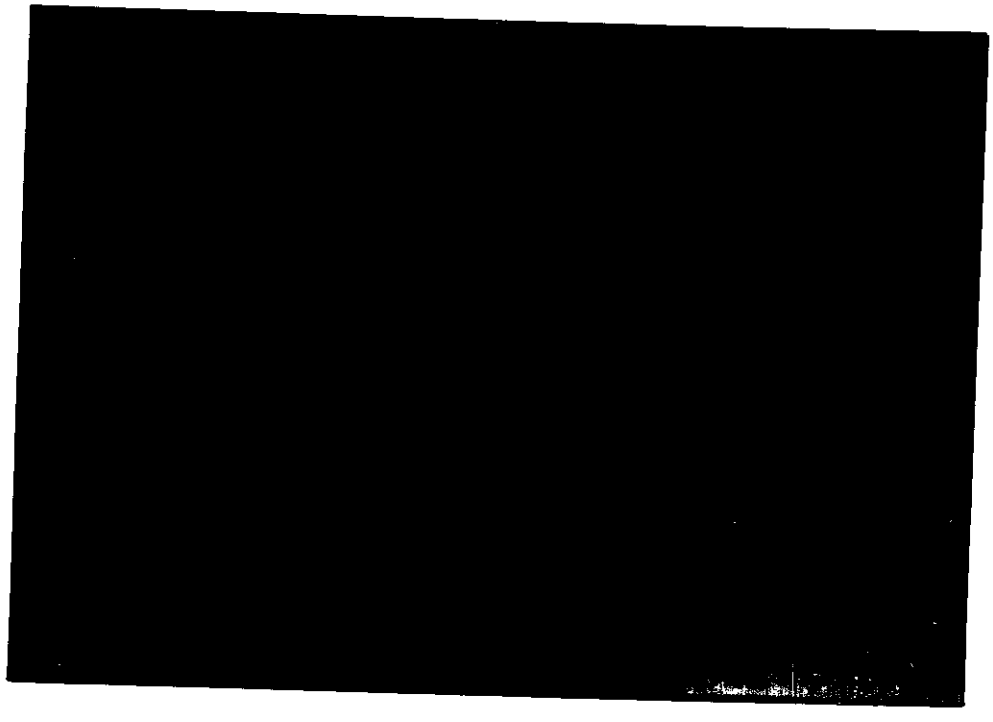


Photo. (3,b)

Photo.(4): (*0.5).

Juvenile portion of "Pothos" plant-left to grow horizontally under creeping method condition, showing the development of upper leaf blade surface in one direction upward. See also the great variation in leaf blade shapes and in the degrees of variegation proportions of green and white yellowish islands on the same plant. This great variance in blade shapes and variegation makes "Pothos" plant to be one of the most shapely and showy decorated plants, and hence as one of the most expansion indoor plants.

Photo.(5,a) (*1): Well-decorated show leaf blade of "Pothos" plant showing the clear greet white variegation islands. See also the broad-ovate type shape of leaf blade with cordate shape at base, and the curvature bending of leaf petiol.

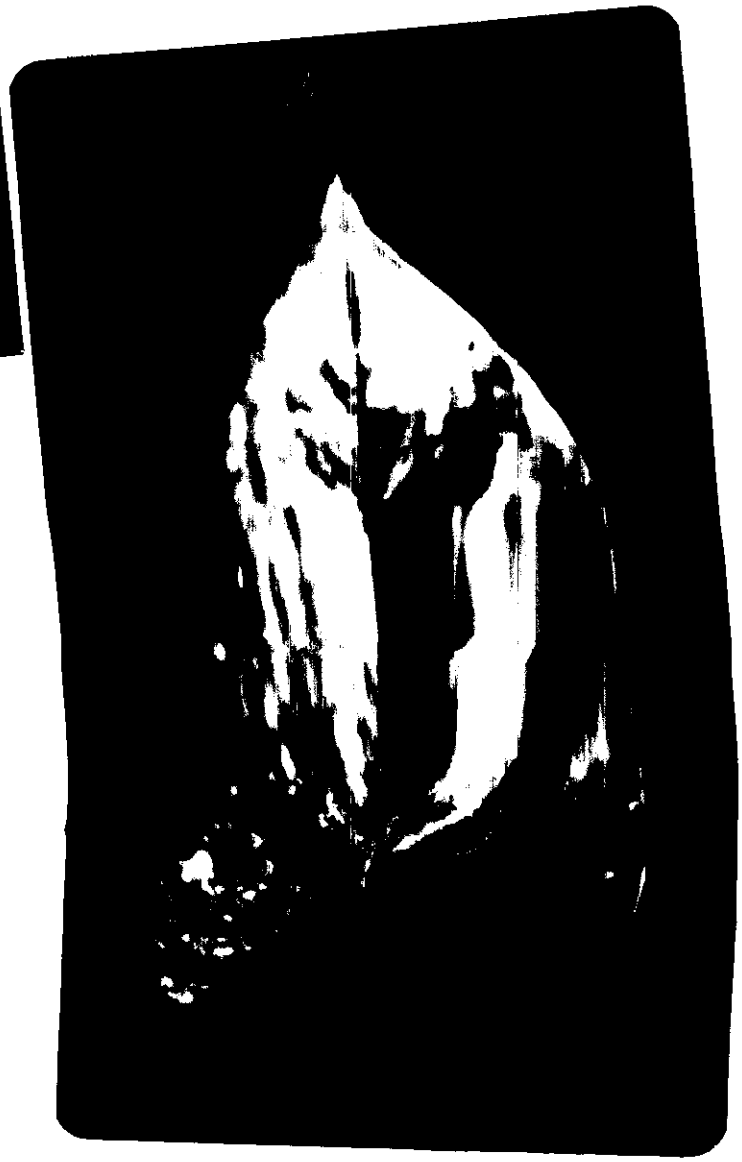


Photo.(5,b) (*1):
Well-decorated showy leaf blade of "Pothos" plant see: the mid white yellowish variegation, the position of mid-rip divides leaf blade into two un-equal sides, the deviotion of the left leaf blade margin by bending curvature into inside, and the cordate shaped blade base.

Photo. (5,c)(*1):

Well-decorated showy leaf blade of "Pothos" plant showing great distribution of green and white yellowish spoted islands. The leaf blade shape is oblong -ovate with cordate shape at base.

Photo. (5,d)(* 0.5):

Portion of "Pothos" plant showing (i) a great variation in variegation and shape of leaf blades. (ii) The un-central mid-rip of the upper leaf blade is more obvious than the other leaf blades on the same plant.

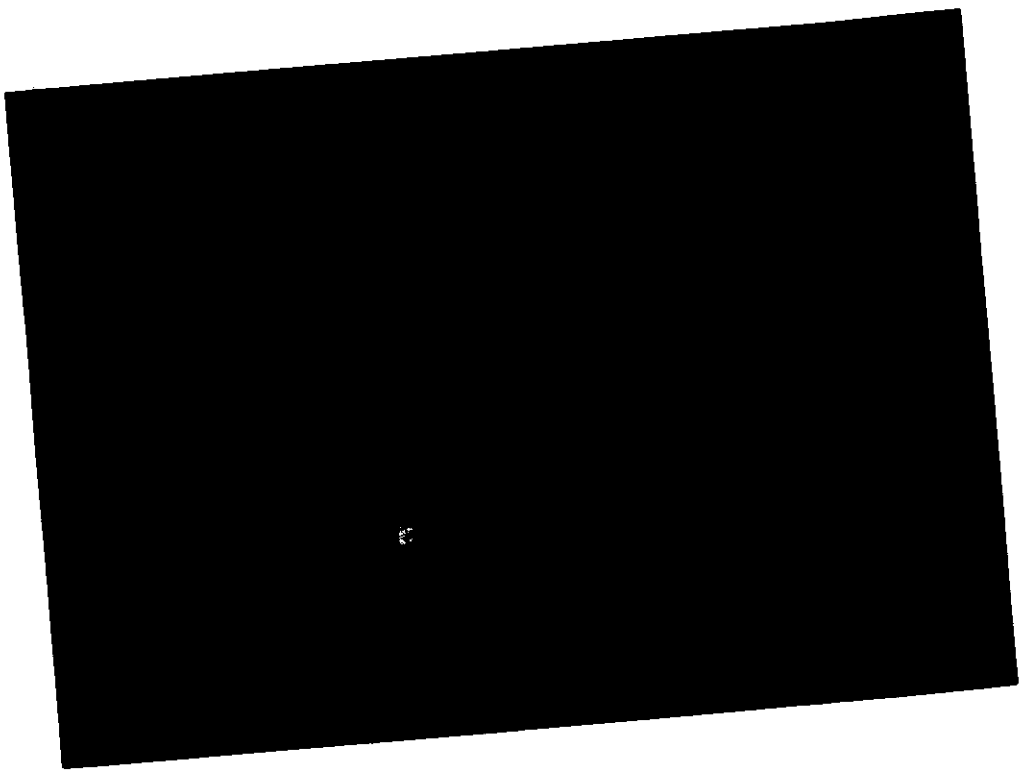


Photo.(5,e) (*1): The youngest terminal "Pothos" leaf, immediately before full expantion and bending to the suitable correct position, as the right leaf margin is still curve into inside.

(2) Philodendron scandens (P. Scandens oxycardium, Grof, 1986).

This species is known in horticulture as *"P.cordatum"; prehinnaean as "hederaceum"*. The most popular and widely sold vining ***Philodendron,*** known as "Heart leaf Philodendron" or "Parlor ivy", or simply "Cordatum vine in Europe" This species is not popular in Egypt like "Pothos" and some times mis known to be "Pothos" by the common horticulturist. For decoration, this species may be used in many ways, as a cascading vine in pots, baskets, window boxes, or room dividers, or it may be trained against support, preferably on mossed poles, bark slabs, or milled treefern pillars. This species is most tolerate to the adverse condition than *"Pothos"*.

This species is a tall tropical, rapid climber by aerial roots. Its origin habitat is extended from Puerto Rico to Jamaica and Central America. It must be mentioned that such tropical plants of Araceae members especially ***Philodendron*** species seem to change their growth behaviour under the different environmental factors, as these members go normally flowring in their origin habitat without any tendency to bloom under Egyptian condition. This recorded photos, from (6 to 11) explained clearly the morphogensis structure of ***Philodendron scandens.*** The growth behaviour of such species seems to be more or less simeilar to those described in ***Scindapsus aureus,*** as both exhibit the one side direction of foliage upper leaf blade surface. Also, both could be grown under climbing, horizantal prostrate, and pending conditions. However, the morphological structure is completely differed between such two species which could be summarized as follows:

a) Philodendron scandens possess only one type of aerial roots which develop from the node as it was defined it as "aerial nodded climber cord tendril roots", while the other type of internoded rootlets is completely absent.

b) Philodendron scandens plants possess two types of leaves at every joint (node). It was defined the first one as "Keel scale like, bladeless, monopodial, membraneous, leathery, sheath, succulence, white reddish, impermanent protective bracteoled like organ ***cataphyll*** surrounding axillary resting bud, in front of it, in the opposite side of the axis joint, another type of leaves and it was defined as "petioleated bladed sympodial foliage leaf". The latter

leaf type is glossy deep green, broadly heart-shaped, soft-leathery, in juvenile stage 10-15 cm long or more under climbing conditions. The variegation is completely absent.

c) Philodendron scandens plant internodes axis are always formed from the development of foliage leaf axillary buds, while the corresponding axillary buds of scale like bracteoled are always in dormant state completely. The later dormant bud renews its activity only after the removal of the terminal bud to develop into a new branch. Accordingly, we define the main axis of ***Philodendron scandens*** as "sympodial scorpioidal stem", while folioge bladded leaf as "sympodial leaf but the bracteol scale like one as" monopodial bladeless scale leaf. "On the other hand" the axis of "Pothos" is always formed from the terminal bud only as "monopodial", while the bracteol scale bladeless like portion is completely absent in the observation under this study course.

d) In spite of the complete differences between the morphological structure of ***Philodendron scandens and Scindapsus aureus,*** but the different organs of both species seemed to be more or less sensitive to the prevailing environmental factors such as the density of light direction, gravity and the bodies of climbing stands. In other words, both species have showed a nastic movements, epinasty or hyponasty, or other wise inplay with tropism.

It must be mentioned that leaf types in the *Araceae* have been discribed by previous authoress in terms of lamina, venatien and shaps. In addition some attention has been given to the development petiolar sheaths **(Engler, 1920 a,b &c; Hotta, 1971; Croat & Bunting, 1979 and Grayum, 1984).** However, such describtion was given in their origin habitat with no attention paid to the morphogensis structure of the *Araceae* members under the conditions out of their origin habitat. It must be mentioned that **Ray** in his detailed studies on 83 species from 27 genera of *Araceae* family which included ***Philodendron scandens*** (only) defined sympodial leaf as the expanded foliage leaf. His study extended under Costa Rica and northeastern U.S.A., origin habitat **(see Ray, 1983 a&b, 1986, 1987 a,b&c & 1988).** His study did not included ***Scindapsus aureus,*** as its origin habitat is Malaysia as defined by **Bailey (1963).**

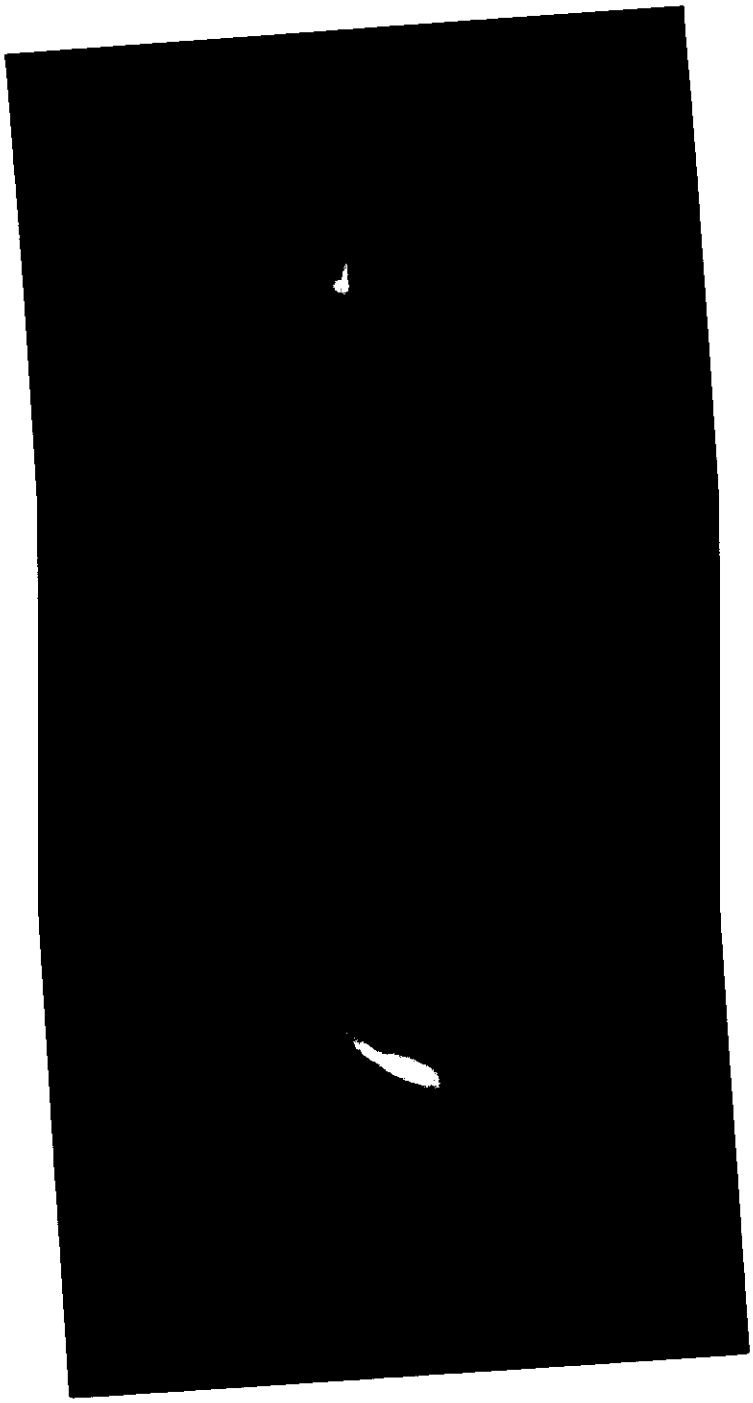


Photo. (6) (*0.5):

Terminal developing juvenile portion of ***Philodendron scandens*** (Parlor ivy: parlour ivy). Note the following morphogensis structures:

a) An open keeled scale like, bladeless, monopodial, membraneous, leathery, sheath, succulence, white reddish, impermanent protective bracteoled like organ, surrounding axillary resting (dormant) bud. In front of it, in the opposite side of the axis, petiolated bladded sympodial faliage leaf is found on the right.

b) Sucker, cordded, nodded, climber, tendril roots pend downward from the joint.

c) Elongated sympodial internode develop from the axillary bud of the foliage leaf ended with terminal budded portion enclosed with unopen keeled scale like bladeless monopodial membraneous bracteoled like portien ***(cataphyll)***.

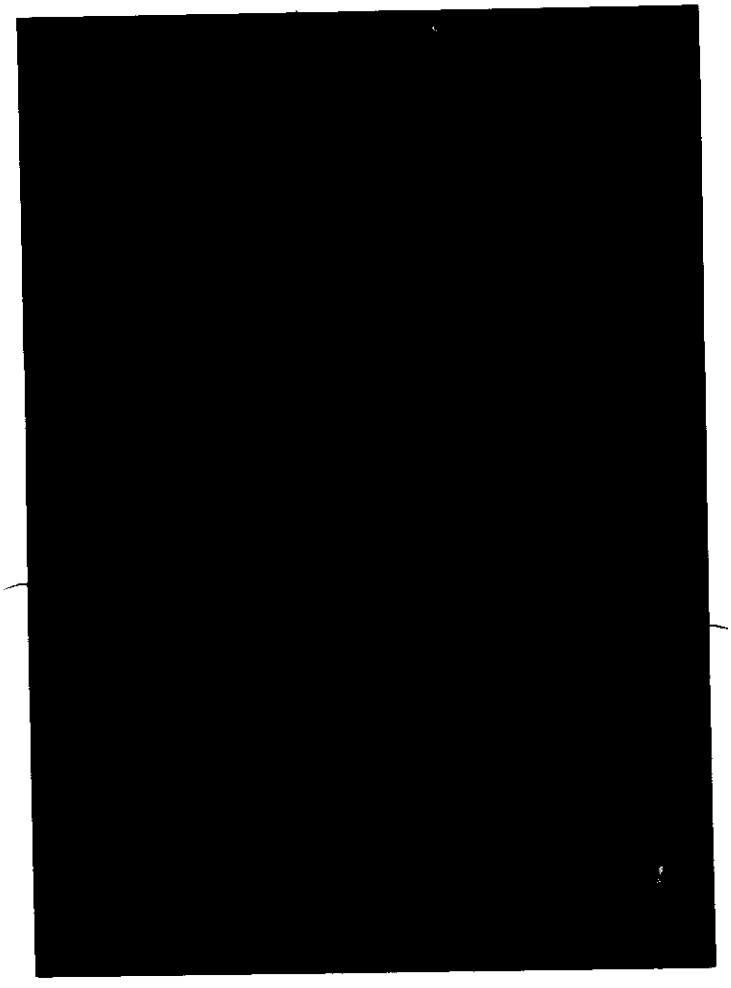


Photo. (7) (* 0.2.5):

Portion of ***Philodendron scandens*** (parlour ivy) showing the organization of its axis as scorpioidal structure. Note also the spiral arrangement of keeled scale like bractuel and the tenderil nodded roots.

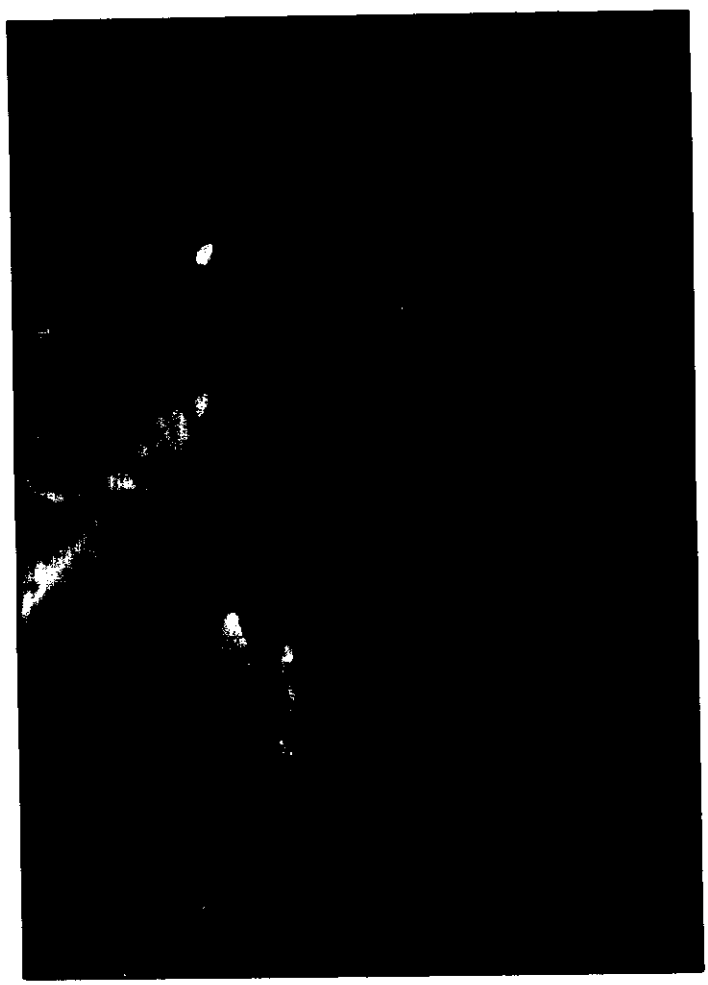


Photo. (8) (*0.25):

Portion of ***Philodendron scandens*** showing deep green, broadly heart-shaped, soft-leathery leaves in juvenile stage (Petiolated bladded sympodial foliage leaves) in horizontal prostrate growth conditions. Note the direction of upper foliage leaves in one side upward. Note also the organization of axis as scorpioidal sympodial structure. See also the dry permanent bracteoled scale like leaf.

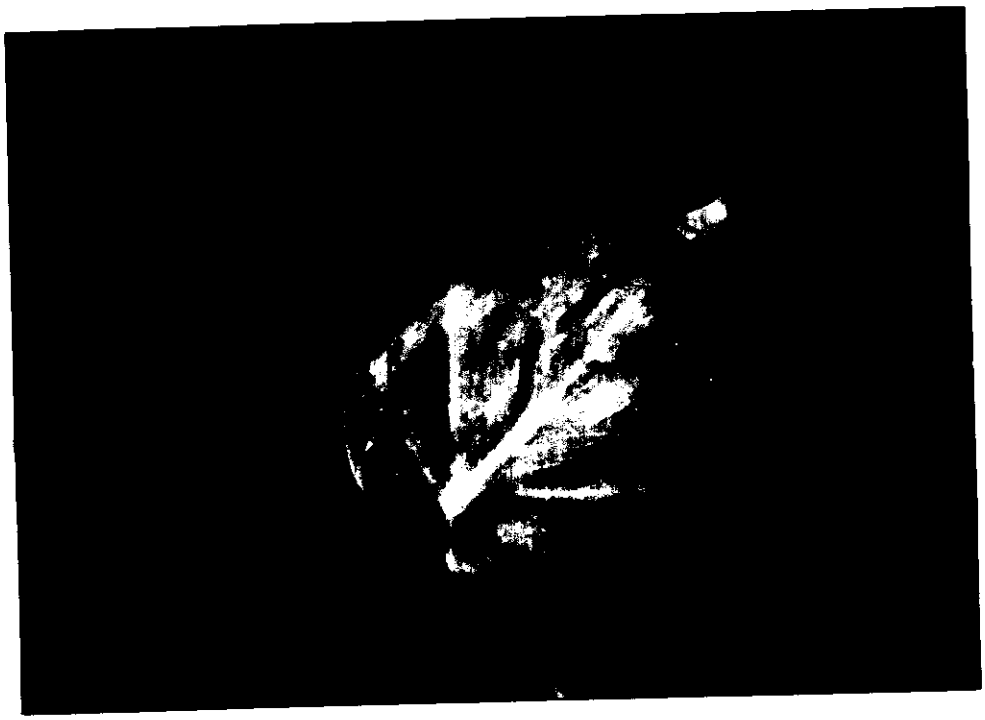


Photo. (9) (*1):

Sympodial apical expanded petiolated bladded foliage leaf, it is pale blue green, broadly heart shaped, soft-leathery, cordate at base, in the apical portion of ***Philodendron scandens***.

3) Philodendorn bipinnatifidum (P.parduraeforme-or bipennifolium) Feddle-leaf or Violin- leaf).

This species is not widely popular and used in Egypt, and some times mis define as "***Anthurium***" "(one of ***Araceae*** genus) by common Egyptian horticulurist. This species is also one of the very decorative climer plant, however, its axis stronger than ***P. scandens,*** climb with un usual leaves shaped like violen (or feddle) (see photos. 14&15). Foliage leaf blade has two basal lobes. However, these lobes shape are very greatly from one leaf to another on the same plant as some leaf bases seem to be more or less as "hastate" (photo, 14), while some another seem to be "sagittate" (Photo, 15).

This species origin habitat is south Brazil. Our recorded photos. from (12-16) explain clearly the morphological structure of such species of ***Philodendron.*** The morphological structure of the present tested species is completely differed when compared with ***P. scandens.*** Growth behaviour also is completely differed between both species which could be summarized as follows:

(a) P.bipinnatifidum stem is more strong than the other species and grow only as a climber, and can not grow prostrate or pending downward.

(b) The climber organs of ***P. bipinnatifidum*** seemed to be unusual leaves beside its nodded aerial roots.

(c) The nodded aerial roots of ***P. bipinnatifidum*** are stronger and thicker than those of the other species, but such roots are cord and tendril, and grow in crowded as the internodes are very small in their length than the corresponding ones of ***P. scandens*** (see photo 13)

(d) There are great differences in foliage leaf shape as leaf blade bases of ***P. bipinnatifidum*** are very greatly as mentioned before. In addition, the direction of its upper leaf surfaces is always upward prostrate. The cataphyll sheathed bracteoled leaves are more obvious in the present tested species comparing to the other corresponding ones of ***P.scandens.***

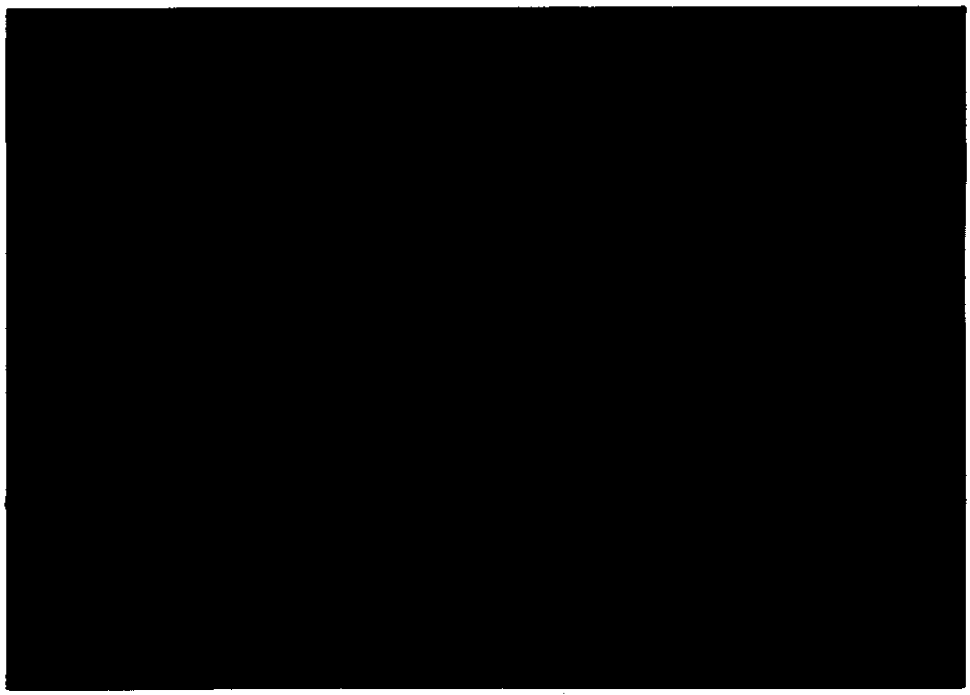


Photo. (12)(*1)

Basal part of apical portion of ***Philodendron bipinnatifidum***. after the removal of scale bracteole like organ, showing the dark brown developing nodded aerial sucker.

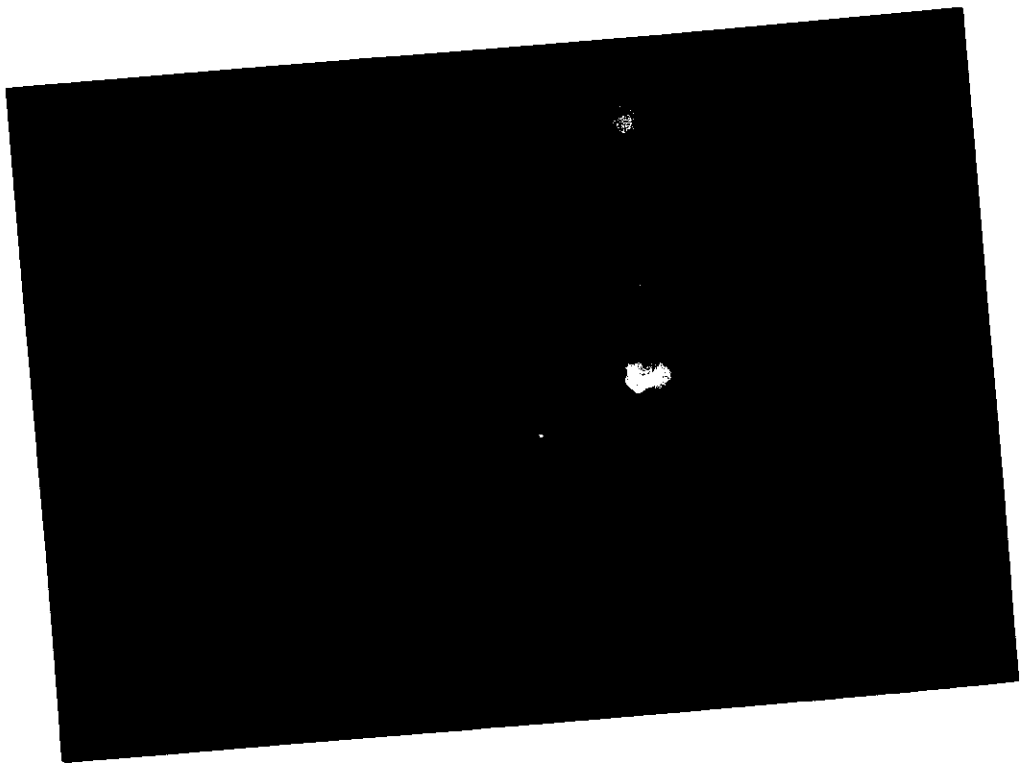


Photo. (13)(* 0.5):

Basal part of apical portion of ***Philodendron bipinnatifidum***. showing the following organs:

a) Scale bracteole like organ (mostly short in size).
b) Numerus nodded aeriol roots in variable developmental stages.
c) Heavy and crowded formation of leaf petiols.

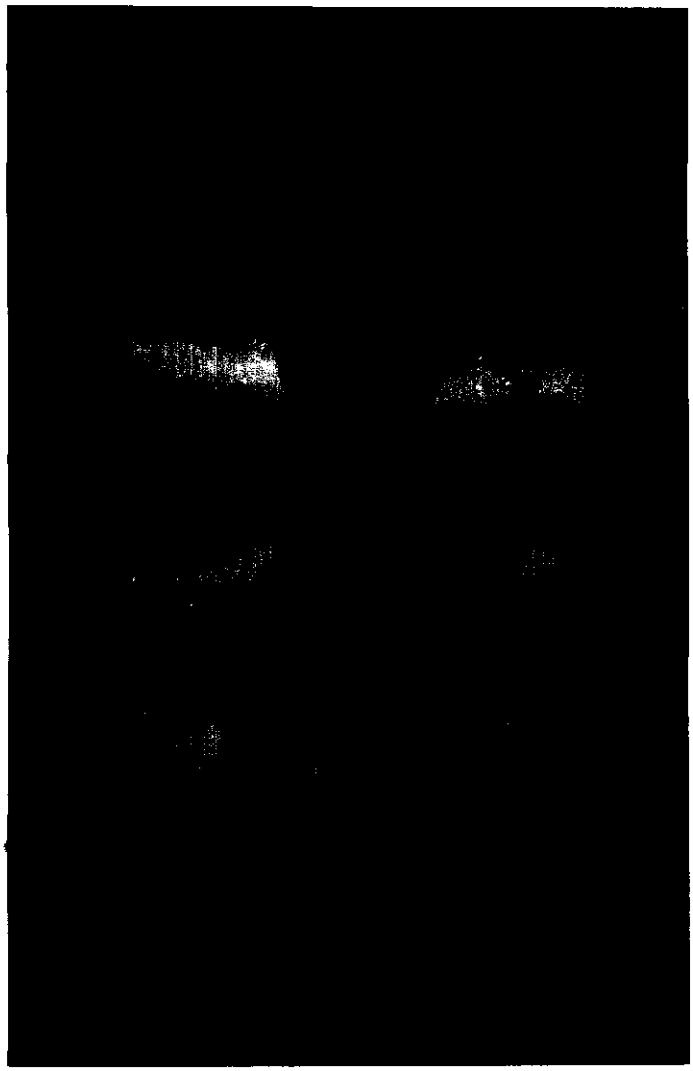


Photo. (15)(*0.5):

. Mature, full expanded, sympodial, foliage bladded leaf of ***Philodendron bipinnatifidum*** on the middle and upper part of the axis, showing a great variation in leaf shape from one to another on the same plant. (see the previous photo). See the unequal two sides of the blade, the basal lodes extend downward, associate with the appearance of small lobelets in the middle of leaf margin. Note also that central lobe is narrowed at its base (nearly at the middle of the leaf blade).

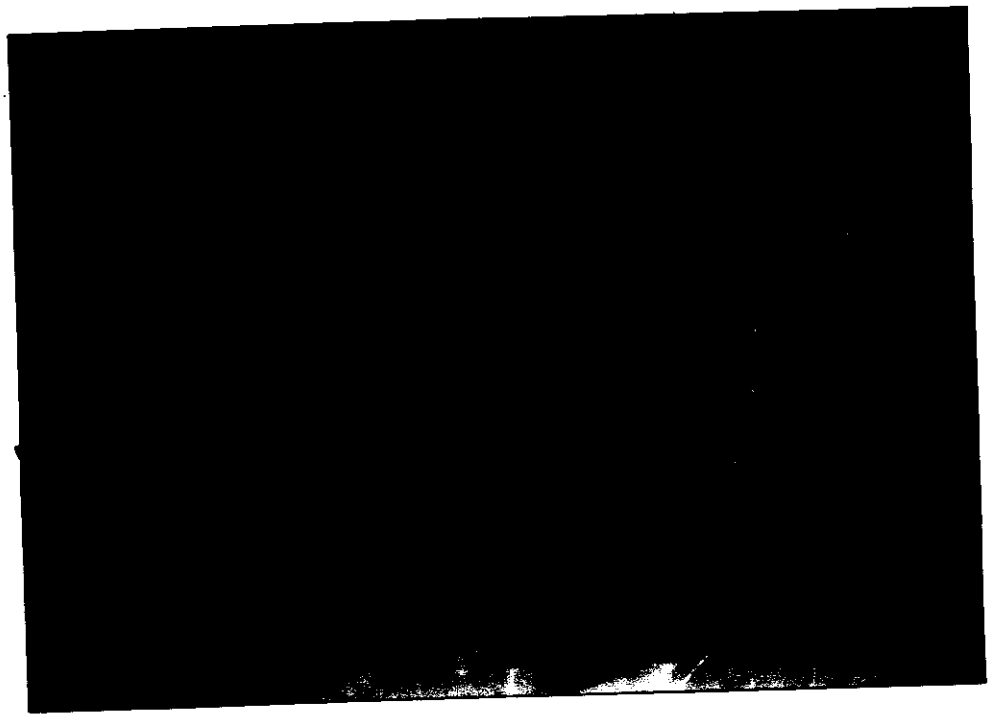


Photo.(16) (* 0.15):

Upper view of whole plant of ***Philodendron bipinnatifidum (P.panduraeforme)*** showing a great variation in its leaf shape and size. Note also the direction of its upper leaf surfaces into upward.

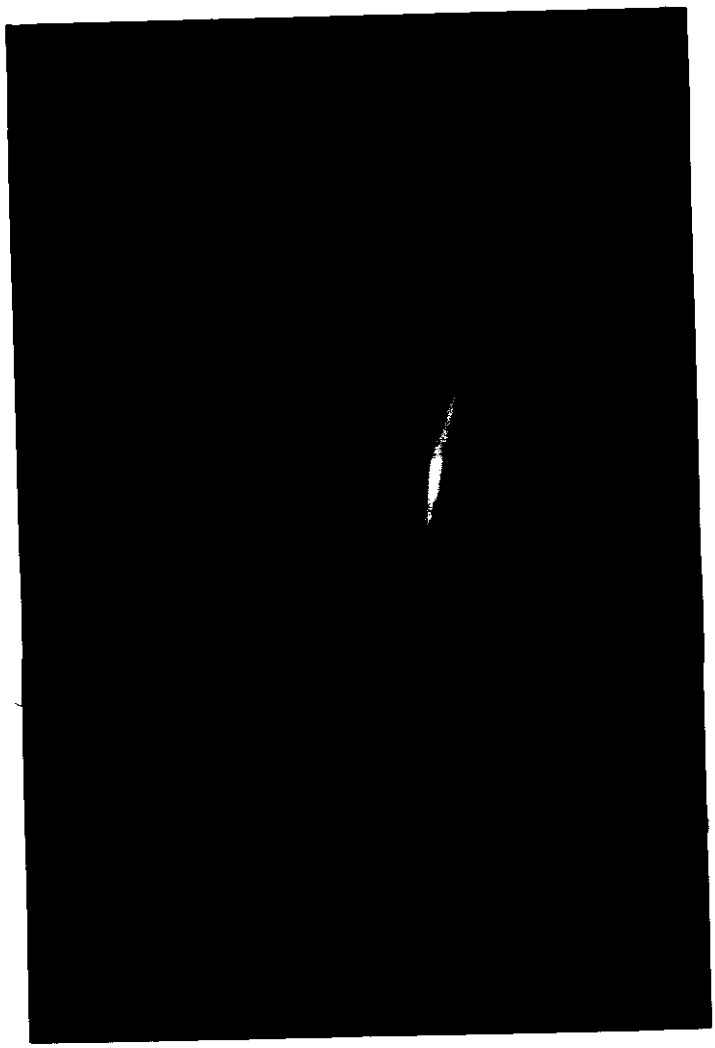


Photo. (17) (*3):

Basal portion of terminal part of ***Philodendron erubescens.*** Note the following organs:

a) Early developing clamberer nodded aerial root (at the left).

b) Cataphyll sheathed bladless im-permanent scale like bracteole organ develops from every joint (sylleptic cataphyll).

c) Root scar is clearly shown at the upper joint.

d) All organs are wine red, pale or dark.

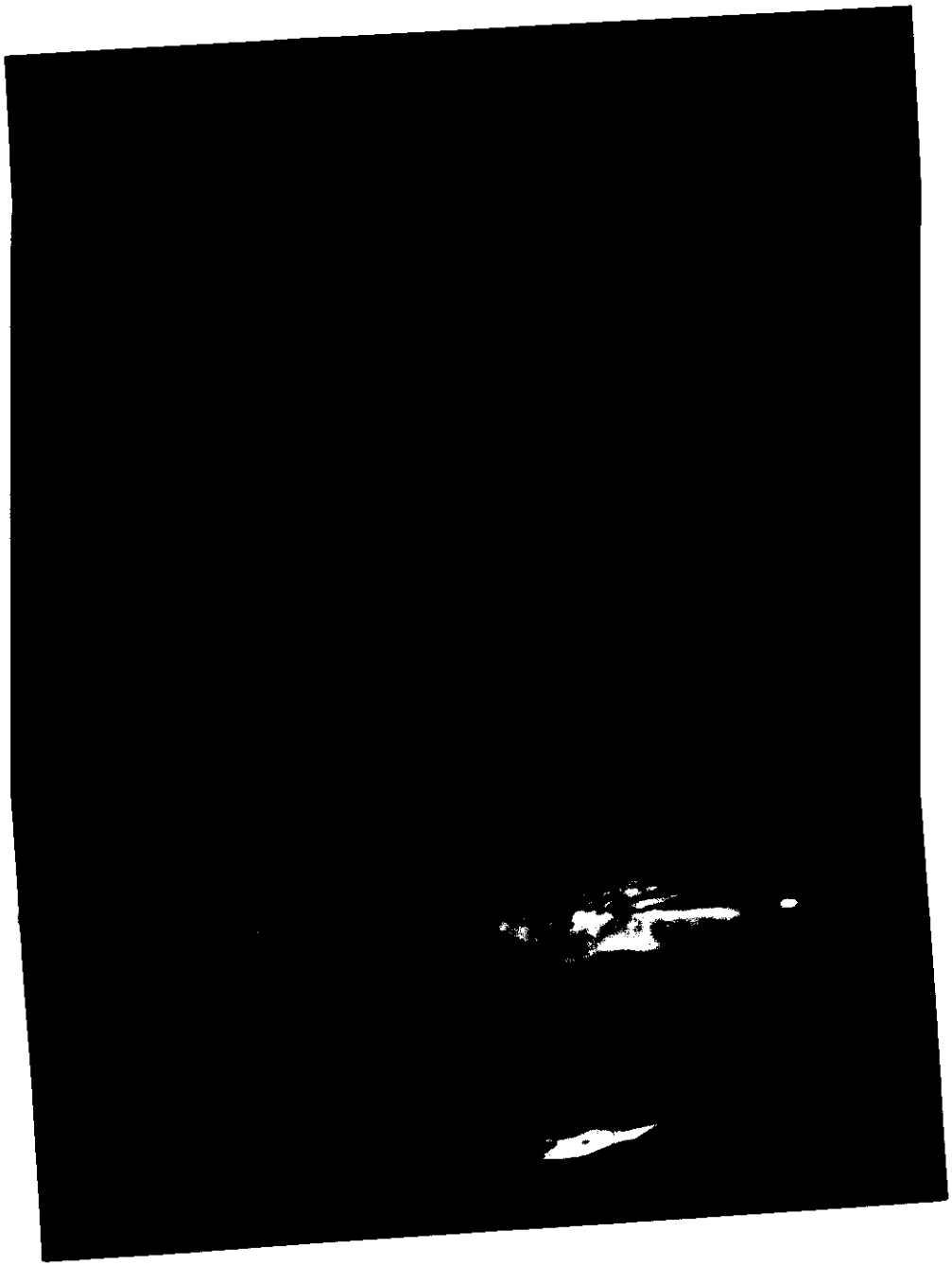


Photo. (18) (* 0.20) :

Juvenile ***Philodendron erubescens.*** showing the following organs:

a) Proleptic prophyll cataphyll bladless sheathed leaves their colour is pale wine red.

b) The arrow shape of foliage leaf.

c) All of the foliage leaf blade upper surfaces organize as upward.

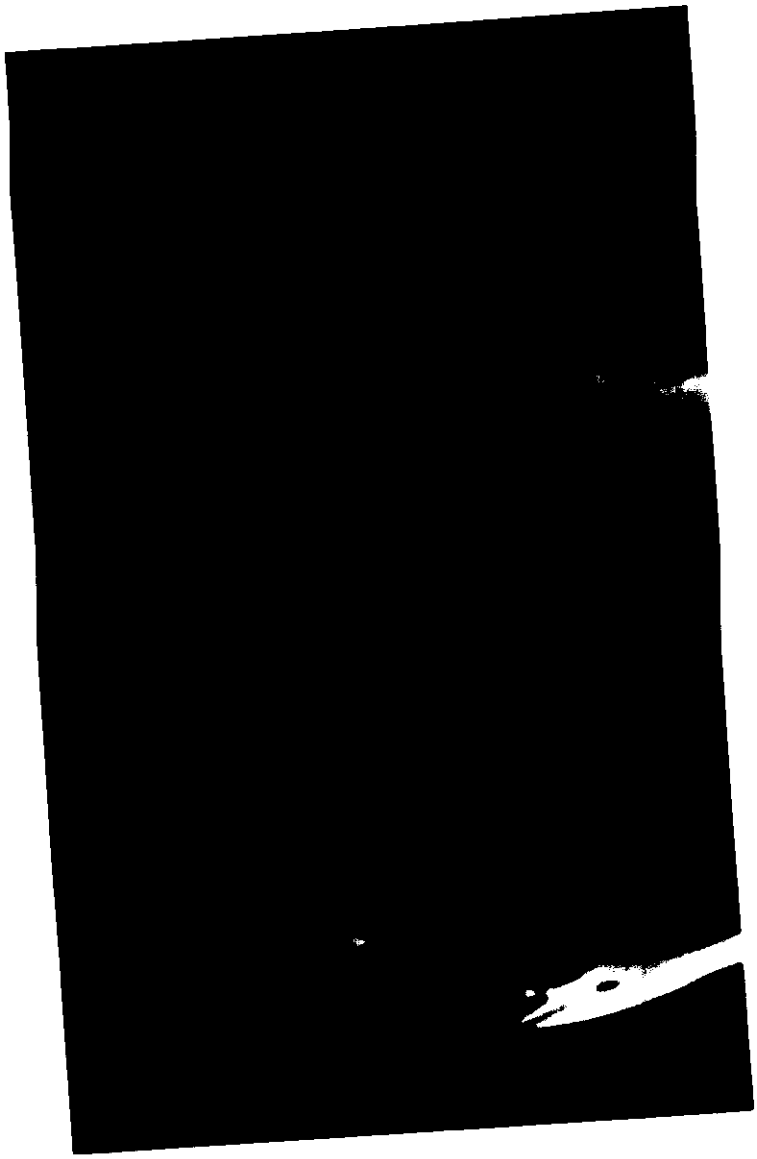


Photo. (19)(* 0.25):
Juvenile ***Philodendron erubescens.*** showing the following organs:
a) Proleptic prophyll cataphyll bladless sheathed leaves.
b) Wine red tall foliage leaf petioles.

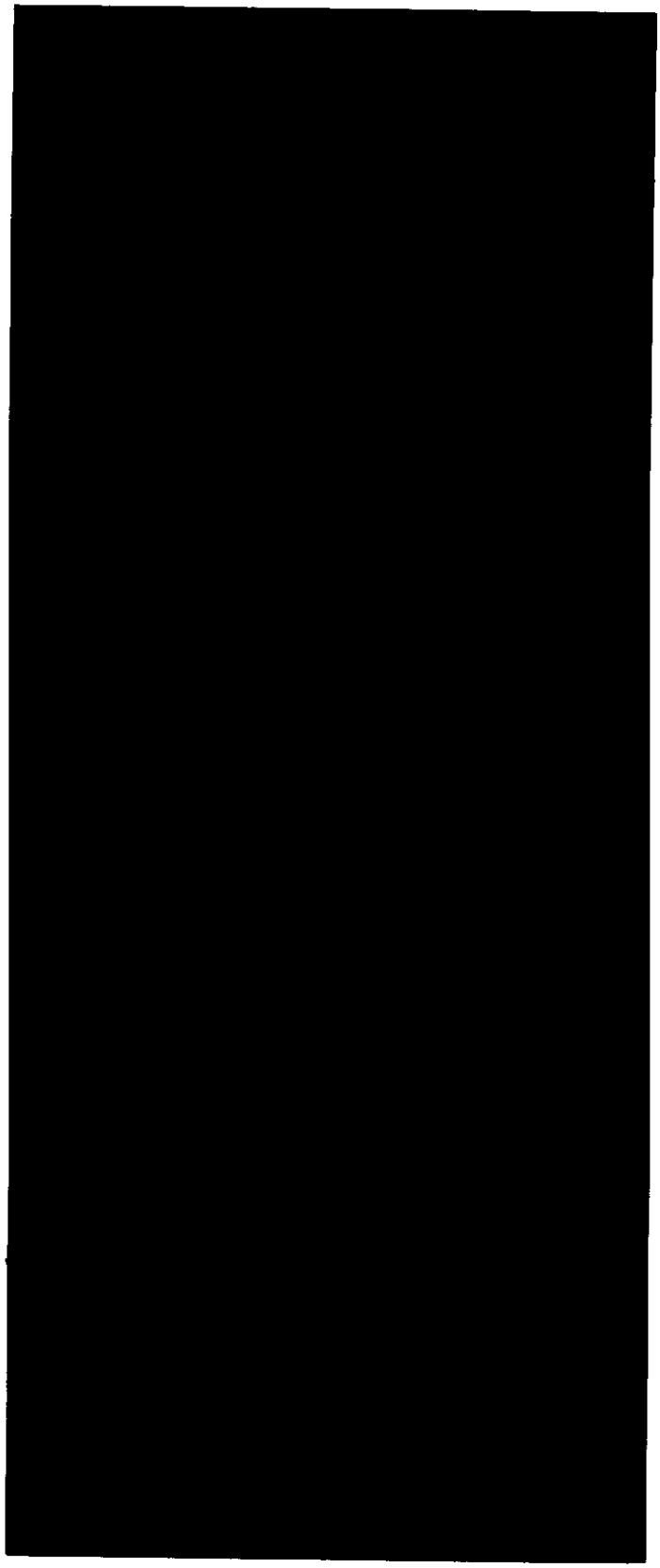


Photo. (20)(∗0.75):

Philodendron erubescens. foliage leaf blade. Note its arrow shape and its bronzy green colour.

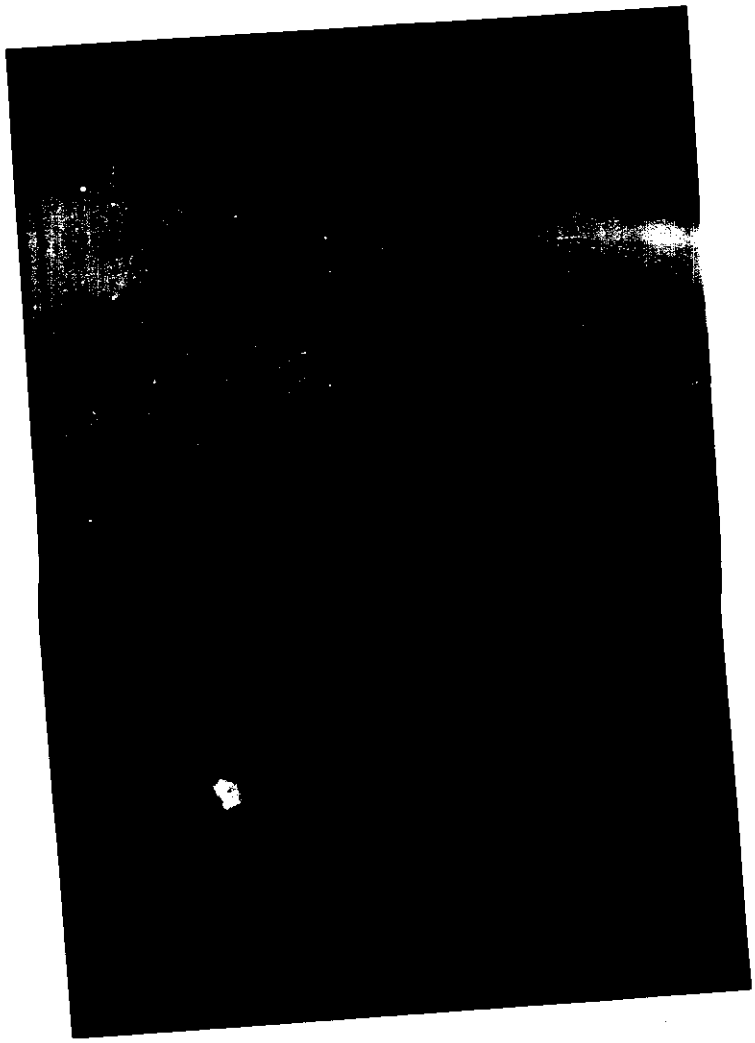


Photo. (21) (* 0.20):

Developing ***Philodendron erubescens*** showing the clear dark wine read colour of sympodial scorpioidal stem organization, and the waxy bronzy green sylleptic foliage leaf blades. Note also the cordded nodded clamberer roots.

Growth pattern and shoot organization of ***Philodendron scandens*** and many other ***Philodendron*** species were defied by **(Ray, 1987)** a&b and 1988. He defined that such species are diphyllus sympodial, the prophyll is a cataphyll, the sympodial leaf is a foliage leaf, and there is a bud on the sympodial segment. He added also that it appears that all tested ***Philodendron*** species conform to the following diagram; **(Ray, 1988):**

$\{_bP_{cs}$ - S_e- I_a

were: P = prophyll

S = sympodial leaf

I = inflorescence (spathe and spadix)

b = vegetative bud

cs = cataphyll sylleptic

e = expanded leaf (foliage leaf)

a = axillary inflorescence sympodium

The same worker also added that ***Philodendron scandens*** shoot organization is characterized by the following pattern:

a) Growth of the mature stem is homeophyllous sympodial(h)

diphyllous, (2) and the articles is originate by prolepsis(p)

(b) the sylleptic articles have a cataphyll prophyll(c).

(c) the sympodial leaf have a normal expanded blade (e).

(d) the bud is present (p)

(e) the shoot rest seasonally is not within resting cataphylls (n)

According to his abbreviation bases the following formula summarizes the growth characters of ***Philodenron scandens:*** h-z-p-c-e-p-n. With regards to other tested two species i.e. ***P. erubesens*** and ***P.bipinnatifidum*** seemed to be more or less similar to those described in ***P.scandens*** specially the organization of shoot. It must be mentioned again that such tropical plants change their growth behavior and may be their shoot organization under the out of their origin habitat, as they cannot bloom completely under Egyptian conditions.

(4) philodendron erubescens (Blushing philodendron)

Its origin habitat is "Colombia" **(Grof, 1986)**. This species as in the case of ***P. bipinnatifidum,*** is not popular in Egypt and also mis belonging under "Anthorium" genus by the common Egyptian horticulturists. Its growth behaviour is typically similar to that mentioned before with ***P. bipinnatifidum,*** as it is very decorative trained clamberer only to poles, and can not be grown as creeping prostrate or pend in hanging pots. The morphological structures are presented in photos. (17-21), which could be summarized as follows:

a) This species posses only one type of root, the climber nodded aerial roots at every joint, as in other ***Philodendron*** species (see photo. 21). Its roots are dark wine red. Its roots are the climbing organ.

b) The shape of its foliage leaf blades is arrow, waxy bronzy green, while the colour of its petioles is wine red especially during winter while it is pale blush during summer.

c) The more than proleptic prophyll cataphyll bladeless (blade absent completely) are clearly developed during the early juvenile stage, see photos (18 & 19). Its colour is wine pale blush.

d) This species possess also as in other ***Philodendron*** species, a cataphyll sheathed bladless impermanent scale like bracteole organ at every joint with its special axillary dormant bud (see photo.17). Thus, the foliage leaf may be considered as sympodial leaf, while the cataphyll sylleptic sheathed bladless leaf on the main axis is considered as monopodial bladless leaf.

e) Its main axis organization, as in other ***Philodendron*** species is considered as sympodial scorpioidal system as every internode results and develops from the axillary bud of foliage bladded leaf.

f) At the end, this species is very delicate to any adverse conditions than any other tested ***Philodendron*** species.

All of the various observations on the four arom plant species could be discussed on the bases of the series of studies of **Ray (1986, 1987, a&b 1988).**

According to **Engler (1905)** all "Pothos" leaves on main shoot are monopodial leaves. **Ray (1986, 1987a,b&c & 1988)** applied new terms in ***Araceae*** members leaves, as monopodial, sympodial, proleptic, sylleptic, resting, reduced and foliage leaf.

This represents an unconventional terminology because some of the modifiers refer to the structure of the stem to which the leaves are attached, rather than to the form of the leaf itself. **Ray** also added that successive articles are assembled into chains which are physiognonically unbranched shoots. In addition, **Ray (1986, 1987a,b&c & 1988)** in his study on ***Araceae*** family members indicated that ***Philodendron species*** new shoots which emerge after the resting condition stage (Unknown time) showing proleptic morphology, with a series of proleptic mesophyll.

It must be mentioned that furtheir studies must be carried out on the growth behaviour of our tested species if the question is to be fully answered.

Seasonal Changes in Growth Criteria.

Seasonal changes in growth criteria of the four tested species in terms of stem length (cm), mean number of full expanded foliage leaf and mean of whole plant foliage leaf blade area (cm^2) were recorded monthly from March 1988 till February 1989 during the first Saturday of every month. Mean of one internode length (cm) (stem length/number of nodes) and mean of one full expanded foliage leaf blade area (cm^2) (whole plant leaf area/number of foliage leaves) were also estimated monthly. These data are tabulated in tables [2,3,4 & 5(a)]. These data were turned into percentage increase (P.I.) and periodical increase percentage (P.I.P) as related to the maximum values attained during the growth period to get some clue information about the nature of growth rate during different periods of growth. These data are tabulated in Tables [2,3,4 & 5(b)] and graphically illustrated in Figs. (1,2,3 & 4). Before discussing the gained results it must be mentioned the following notes.:

i) The growing method of ***Scindapsus aureus*** and ***philodendron scandens*** was the prostrate creeping, while that for ***Philodendron bipinnatifidum*** and ***Philodendron erubescens*** was the erect climbing, as both of the latter cannot grow in prostrate condition and grow only as erect climber.

ib) The measuring of stem length was carried out from its bottom into the basal portion of the terminal bud, while the measuring of leaf area was carried out on full expanded foliage leaf blade only by using the trace method on scale paper with special references and stress on the new formed foliage full expanded blades.

ic) The decorated value of such test species is determined by their stem length, individual leaf area and whole plant foliage blade area.

a) Seasonal change in ***Scindapsus aureus*** growth.

It could be concluded from the data of Table (2,a & b) and Fig.(I) the following conclusion:

i) Stem length increased gradually from March till October then a very slight increase was observed after that till February. The periodical increase percentage indicate that the proportion rate of stem growth increased gradually from March till August then continuous decrease was observed after that in such proportion rate till January and slight increase was observed during February. The grand period of stem growth was clearly

Table(2,a&b): Seasonal changes in *Scindapsus aureus* growth parameters per one plant in terms of stem length, number of leaves, whole plant leaf area, mean of internode length, and mean of one blade area .(a) Absolute values of the tested parameters.(b) Percentage increase and periodic increase percentage as related to the maximum values attained during the growth periods.

TABLE (2,a).

paramter	Mar.	Apr.	May	Jun	Jul.	Aug.	Sep.	Oct.	Nov.	Dec .	Jan.	Feb.
Stem Length (cm)	2.7	10.3	25.6	46.1	70.8	101.6	131.7	150.6	151.6	152.0	152.3	155.3
LeafNo.	2.0	3.0	5.0	7.4	10.8	15.3	20.1	25.3	26.4	26.7	26.7	27.0
Whole plant Leaf area (cm2)	48.6	82.8	157.5	263.4	428.8	635.0	838.2	1037.3	1048.1	1054.7	1054.7	1061.1
Internode Length (cm)	1.4	3.4	5.1	6.2	6.6	6.6	6.6	6.0	5.7	5.7	5.7	5.8
Blade area/ one leaf (cm2)	24.3	27.6	31.5	35.6	39.7	41.5	41.7	41.0	39.7	39.5	39.5	39.3

L.S.D. 5% Stemlength:2.1 Leaf No.:0.3 Whole plant leaf area:8.3 Internode length:0.2
Blade area/ one leaf: 1.4

(Table 2,b)

Stem length	P.I.	1.7	11.1	16.5	29.7	45.6	65.4	84.8	97.0	97.6	97.9	98.1	100
	P.I.P.	+4.9	+9.9	+13.2	+15.9	+19.8	+19.4	+12.2	+0.6	+0.3	+0.2	+1.9	
Leaf No.	P.I.	7.4	11.1	18.5	27.4	40.0	56.7	74.4	93.7	97.8	98.9	98.9	100
	P.I.P.	+3.7	+7.4	+8.9	+12.6	+16.7	+17.7	+19.3	+4.1	1.1	±0.0	±1.1	
Whole Plant leaf area	P.I.	4.6	7.8	14.8	24.8	40.4	59.8	79.0	97.8	98.8	99.4	99.4	100
	P.I.P.	+3.2	+7.0	+10.0	+15.6	+19.4	+19.2	+18.8	+1.0	+0.6	±0.0	+0.6	
Inte-rnode leng-th	P.I.	21.2	51.5	77.3	93.9	100.0	100.0	100.0	90.9	86.4	86.4	86.4	87.9
	P.I.P.	+30.3	+25.8	+16.6	+6.1	±0.0	±0.0	-9.1	-4.5	± 0.0	±0.0	+1.5	
Blade area/one leaf	P.I.	58.0	66.2	75.5	85.4	95.2	99.5	100.0	98.3	95.2	94.7	94.7	94.2
	P.I.P.	+7.9	+9.3	+9.9	+9.8	+4.3	+0.5	-1.7	-3.1	-0.5	±0.0	-0.5	

P.I. = Percentage increase. P.I.P. = Periodic increase percentage

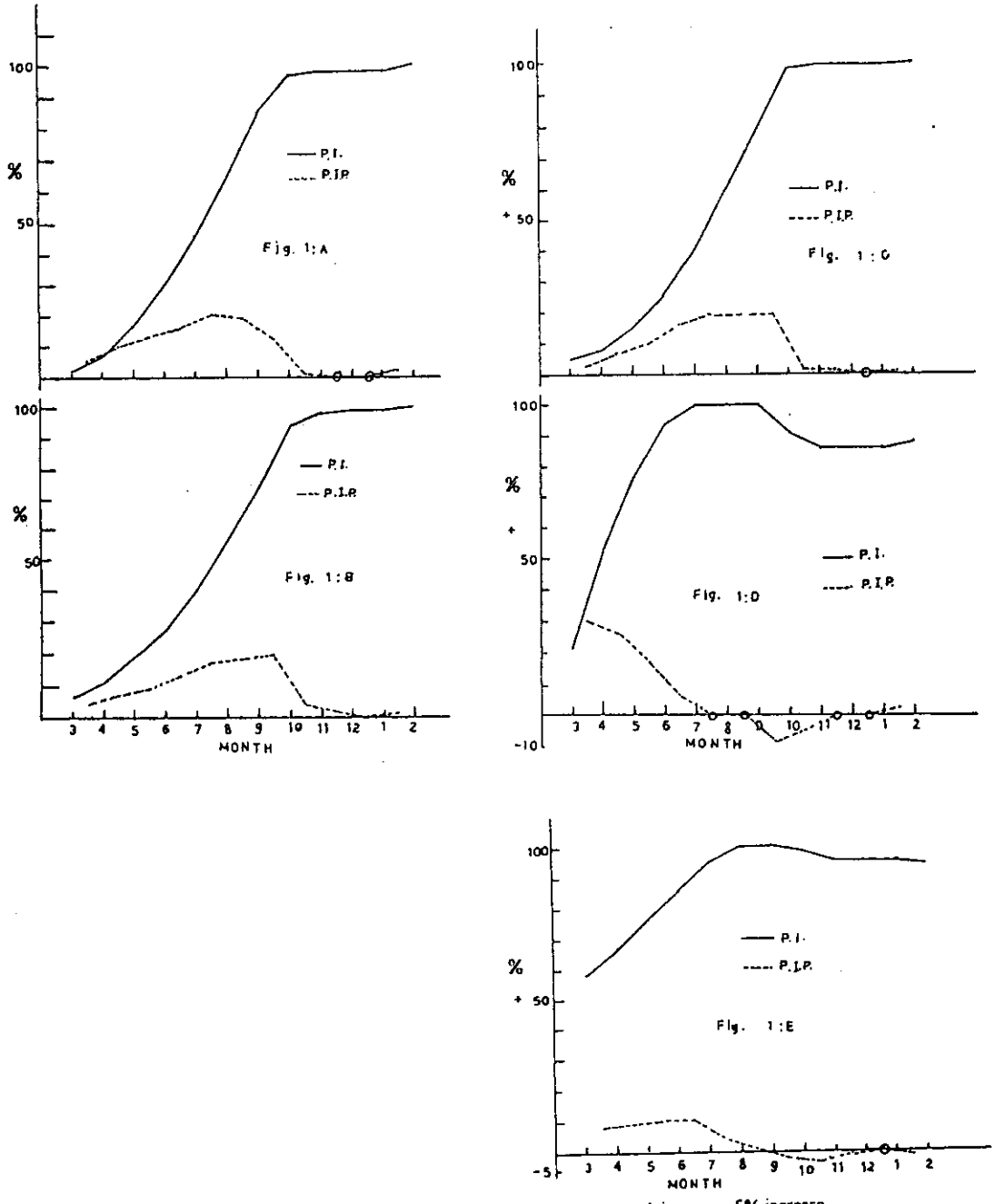


Fig (1): Seasonal changes in *Scindapsus aureus* growth in terms of % increase (P.I.) and periodic increase % (P.I.P.) as related to the maximum values attained during the growth periods of: (A) Stem length; (B) Leaf No/plant; (C) Whole plant leaf area/plant, (D) Mean of internode length; (E) Blade area/one leaf. (Season, 1988-1989).

3: March; 4: April; 5: May; 6: June; 7: July; 8: August; 9: September; 10: October; 11: November; 12: December; 1: January. 2: February

observed from July till September, while the minimum stem growth rate occurred from October till January. In other words, the highest stem growth proportion rate occurred during the most warmest and humidest months, while the lowest one occurred during the most coldest months.

ii) Trend of leaf production rates seemed to be more or less similar to trend of stem growth rates. However, leaf production was completely absent during November, December and January. Accordingly, it was considered that ***Scindapsus eureus*** may be in dormant or rest stage from November till January, during which new formed leaves were absent.

iii) Whole plant leaf area showed the same trend of leaf number. This added more support to our suggestion that the growth activity occurred during the more warmest and humidest months, while during the cold monthes ***Scindapsus aureus*** plant enter into dormant or rest stage.

iv) Mean values of internode length and leaf area/one leaf were in their lowest value during early periods of growth (March) then increased gradually during the most active growth periods, but seemed to be more or less mostly constant during the rest or dormant stage. However, some decline in leaf area/one leaf may be observed during such dormant stage. Some fluctution may be observed during the resting stage in the proportion rates of internode length or leaf area. In addition, the changes in internode length value may be correlated with the changes in leaf area/one leaf value as both showed the lowest values during the early period of growth.

v) It could be concluded that the growth curves of stem-leaf production rate, blade area/one leaf, and whole plant leaf area on percentage rate proportions bases are typically sigmoid shape (Fig I).

b) Seasonal changes in ***Philodendron scandens*** growth.

It could be stated from the data of Table (3,a &b) and Fig.(2) the following conclusions:

i) The seasonal changes trends in ***Philodendron scandens*** growth parameters seemed to be more or less similar to those corresponding ones of ***Scindapsus aureus***, as stem length, leaf formation number, and whole plant leaf area increased gradually from

Table (3,a&b): .Seasonal changes in *Philodendron scandens* growth parameters per one plant in terms of stem length, number of leaves, whole plant leaf area, mean of internode length, and mean of one blade area (a) Absolute values of the tested parameters. (b) Percentage increase and periodic increase percentage as related to the maximum values attained during growth periods.

TABLE (3,a).

Parameter	Mar.	Apr.	May	Jun	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.
Stem Length (cm)	5.3	15.7	30.4	47.5	66.5	100.5	134.2	152.1	154.9	155.0	165.0	161.9
Leaf No.	2.1	3.1	5.1	7.3	10.3	15.2	20.1	25.1	26.0	26.0	26.1	27.0
Whole plant Leaf area (cm2)	38.2	62.9	129.5	211.6	366.7	547.2	731.6	913.6	946.4	946.4	950.0	958.5
Inter node Length (cm)	2.5	5.1	6.0	6.5	6.5	6.6	6.7	6.1	6.0	6.0	6.0	6.0
Blade area/ one leaf (cm2)	18.2	20.3	25.4	30.5	35.6	36.0	36.4	36.4	36.4	36.4	63.4	35.5

L.S.D. 5%: Stem length: 2.9 Leaf No.: 0.5 Whole plant leaf area : 11.2
Internode length: 0.3 Blade area/one leaf : 2.0

(Table 3,b)

Stem length	P.I.	3.3	9.7	18.8	29.3	41.1	62.1	82.9	93.9	95.7	95.7	96.4	100.0
	P.I.P.		+6.4	+9.1	+10.5	+11.8	+21.0	+20.8	+11.0	+1.8	±0.0	+0.7	+3.6
Leaf No.	P.I.	7.8	11.5	18.9	27.0	38.1	56.3	74.4	93.0	96.3	96.3	96.7	100.0
	P.I.P.		+3.7	+7.4	+8.1	+11.1	+18.2	+18.1	+18.6	+3.3	±0.0	+0.4	+3.3
Whole Plant leaf area	P.I.	4.0	6.6	13.5	23.3	38.3	57.1	76.3	95.3	98.7	98.7	99.1	100.0
	P.I.P.		+2.6	+6.9	+9.7	+15.1	+18.8	+19.2	+19.0	+3.4	±0.0	+0.4	0.9
Inter-node length	P.I.	37.3	76.1	89.6	97.0	97.0	98.5	100.0	91.0	89.6	89.6	89.6	89.6
	P.I.P.		38.8	13.5	7.4	±0.0	+1.5	+1.5	-9.0	-1.4	±0.0	±0.0	±0.0
Blade area one leaf	P.I.	50.0	55.8	69.8	83.8	97.8	98.9	100.0	100.0	100.0	100.0	100.0	97.5
	P.I.P.		5.8	14.0	+14.0	+14.0	+1.1	+1.1	±0.0	±0.0	±0.0	±0.0	-2.5

P.I. = Percentage increase. P.I.P. = Periodic increase percentage

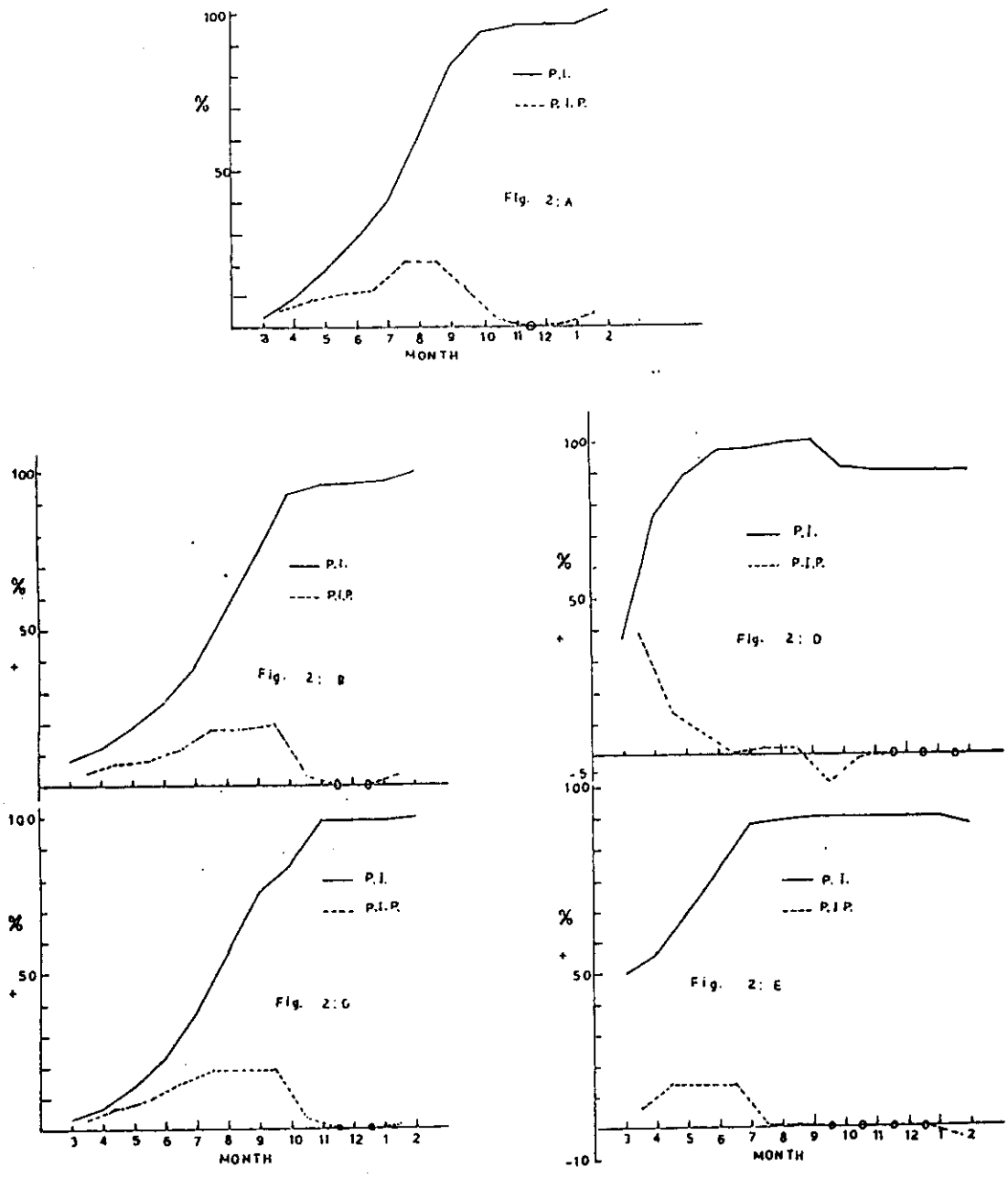


Fig (2): Seasonal changes in *Philodendron scandens* growth in terms of % increase (P.I.) and periodic increase % (P.I.P.) as related to the maximum values attained during the growth periods of: (A) Stem length; (B) Leaf No/plant; (C) Whole plant leaf area/plant; (D) Mean of internode length; (E) Blade area/one leaf. (Season, 1988-1989).

3: March; 4: April; 5: May, 6: June; 7: July; 8: August; 9: September; 10: October; 11: November; 12: December; 1: January; 2: February

March 1988 till February 1989. However, the rate of such increments seemed to be varied greatly from month to another.

ii) The grand periods of growth rates seemed to be occurred during the most warmest and humidest periods (from July till September). The resting periods seemed to be happened during the most coldest period (from November till February), as during such periods the growth proportion rates were either Zero or in their lowest amounts.

c) Seasonal changes in ***Philodendron bipinnatifidum*** growth.

It could be concluded from the data of table (4,a&b) and fig (3) the following conclusions:

i) The seasonal changes in different tested parameters seemed to be more or less take the having simelar trends of those described before in ***Scandapsus aureus*** and ***Philodendron scandens.*** However, stem length, leaf number, internode length values were lower than those corresponding ones of the previous species. In addition, the ***vice versa*** was noticed for blade area per one foliage and whole plant leaf area values.

ii) The rate of stem length increased gradually from March till August 1988 then decreased gradually till it reached the minimum during December 1988. The proportion rate of leaf formations seemed to be more or less constant from April till August then declined gradually till November, as no formed leaves were noticed till February 1989.

iii) It may be suggested that ***Philodendron bipinnatifidum*** plant was in dormant or rest state during the months extended from November till February, as no increase in leaf number, whole plant leaf area, internode length and one blade foliage area.

d) Seasonal changes in ***Philodendron erubescens*** growth.

It could be noticed the following conclusion from the data of Table (5,a&b) and Fig.(4):

i) The same trend mostly observed in the different tested parameters as it was shown in different previous tested species.

ii) There was some gradual decline in the mean area of one foliage leaf blade from August till December of 1988,as the highest area was obtained during July.

iii) The dormant or resting period seemed to be similar to those described in the previous species.

Table (4,a&b): Seasonal changes in *Philodendron bipinnatifidum* growth parameters per one plant in terms of stem length, number of leaves, whole plant leaf area, mean of internode length, and mean of one blade area (a) Absolute values of the tested parameters. (b) Percentage increase and periodic increase percentage as related to the maximum values attained during growth periods.

Table (4,a).

parameter	Mar.	Apr.	May	Jun	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan .	Feb.
Stem Length (cm)	1.1	3.9	8.5	13.3	19.3	25.9	32.0	36.7	38.0	38.1	38.2	38.4
Leaf No.	2.0	3.1	5.3	7.5	9.7	11.9	13.7	14.7	15.4	15.4	15.4	15.4
Whole plant Leaf area (cm2)	140.6	223.5	392.2	567.8	749.8	941.3	1070.	1111.3	1142.7	1142.7	1142.7	1142.7
Internode length (cm)	0.6	1.3	1.6	1.8	2.0	2.2	2.3	2.5	2.5	2.5	2.5	2.5
Blade area/ one leaf (cm2)	70.3	72.1	74.0	75.7	77.3	79.1	78.1	75.6	74.2	74,2	74.2	74.2

L.S.D. 5%: Stem length: 1.1 Leaf No.: 0.4 Whole plant leaf area: 10.4
Internode length: 0.2 Blade area/one leaf: 1.3

(Table 4,b)

Stem length	P.I.	2.9	10.2	22.1	34.6	50.3	67.4	83.3	95.6	99.0	99.2	99.5	100.0
	P.I.P.		+7.3	+11.9	+12.5	+15.7	+17.1	+15.9	+12.3	+3.4	+0.2	+0.3	+0.5
Leaf No.	P.I.	13.0	20.1	34.4	48.7	63.0	77.3	89.0	95.5	100.0	100.0	100.0	100.0
	P.I.P.		+7.1	14.3	+14.3	+14.3	+14.3	+11.7	+6.5	+4.5	±0.0	±0.0	±0.0
Whole Plant leaf area	P.I.	12.3	19.6	34.3	49.7	65.6	82.4	93.6	97.3	100.0	100.0	100.0	100.0
	P.I.P.		+7.3	+14.7	+15.4	+15.9	+16.8	+11.2	+3.7	+2.7	±0.0	±0.0	±0.0
Inte-rnode length	P.I.	24.0	52.0	64.0	72.0	80.0	88.0	92.0	100.0	100.0	100.0	100.0	100.0
	P.I.P.		+28.0	+12.0	+8.0	+8.0	+8.0	+4.0	+8.0	±0.0	±0.0	±0.0	±0.0
Blade area one leaf	P.I.	88.9	91.2	93.6	95.7	97.7	100.0	98.7	95.6	93.8	93.8	93.8	93.8
	P.I.P.		+2.3	+2.4	+2.1	+2.0	+2.3	-1.3	-3.1	-1.8	0.0	0.0	0.0

P.I. = Percentage increase . P.I.P. = Periodic increase percentage

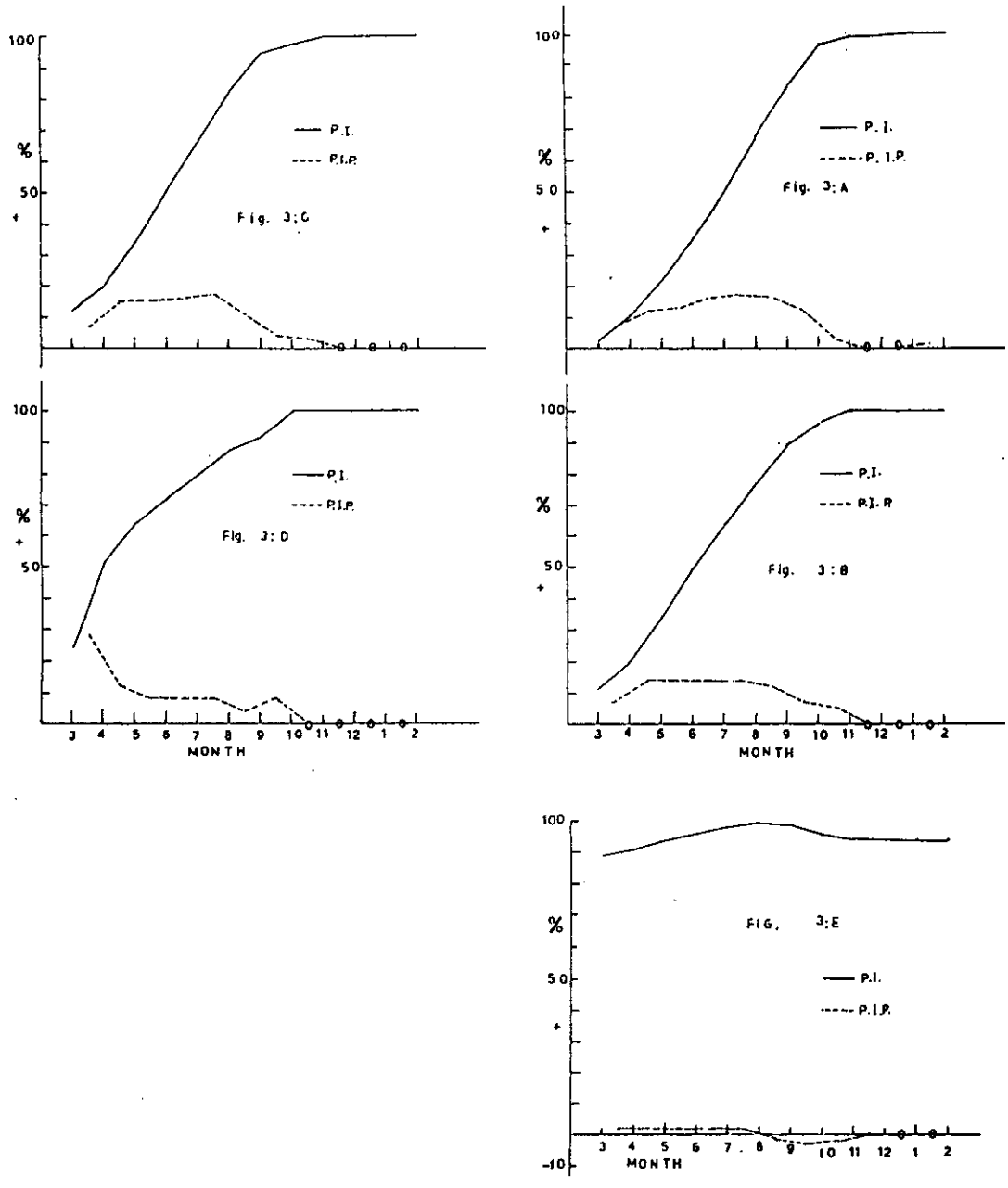


Fig (3): Seasonal changes in *Philodendron bipinnatifidum* growth in terms of % increase (P.I.) and periodic increase % (P.I.P.) as related to the maximum values attained during the growth periods of: (A) Stem length; (B) Leaf No/plant; (C) Whole plant leaf area/plant; (D) Mean of internode length; (E) Blade area/one leaf. (Season, 1988-1989).

3: March; 4: April; 5: May; 6: June; 7: July; 8: August; 9: September; 10: October; 11: November; 12: December; 1: January; 2: February

Table (5,a&b): Seasonal changes in *Philodendron erubescens* growth parameters per one plant in terms of stem length, number of leaves, whole plant leaf area, mean of internode length, and mean of one blade area (a) Absolute values of the tested parameters. (b) Percentage increase and periodic increase percentage as related to the maximum values attained during growth periods.

Table (5,a).

Parameter	Mar.	Apr.	May	Jun	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.
Stem Length (cm)	0.2	1.4	4.3	10.1	16.2	23.7	30.4	33.6	35.0	35.1	35.2	35.3
Leaf No.	1.0	2.1	3.9	6.1	8.2	10.1	11.8	13.3	14.2	14.2	14.2	14.2
Whole plant Leaf area (cm2)	69.7	159.5	317.1	567.9	767.5	918.1	119.5	1081.3	1097.9	1097.7	1097.7	1097.7
Internode Length (cm)	0.2	0.7	1.1	1.7	2.0	2.3	2.6	2.5	2.5	2.5	2.5	2.5
Blade areal one leaf (cm2)	69.7	74.5	81.3	93.1	93.6	90.9	86.4	81.3	77.3	77.3	77.3	77.3

L.S.D. 5% Stem length:1.0 Leaf No.:0.3 Whole plant leaf area : 12.4
L.S.D. 5% Internode length :0.1 Blade area/one leaf : 2.0

(Table 5,b)

Stem length	P.I.	0.6	4.0	12.2	28.6	45.9	67.1	86.1	95.2	99.2	99.4	99.7	100.0
	P.I.P.		+3.4	+8.2	+16.4	+17.3	+21.2	+19.0	+9.1	+4.0	+0.2	+0.3	+0.3
Leaf No.	P.I.	7.0	14.8	27.5	43.0	57.7	71.1	83.1	93.7	100.0	100.0	100.0	100.0
	P.I.P.		+7.8	+12.7	+15.5	+14.7	+13.4	+12.0	+10.6	+6.3	±0.0	±0.0	±0.0
Whole Plant leaf area	P.I.	6.3	14.3	28.9	51.7	69.9	83.6	92.9	98.5	100.0	100.0	100.0	100.0
	P.I.P.		+8.0	+14.6	+22.8	+18.2	+13.7	+9.3	+5.6	+1.5	±0.0	±0.0	±0.0
Inte-rnode length	P.I.	7.7	26.9	42.3	65.4	76.9	88.5	100.0	96.2	96.2	96.2	96.2	96.2
	P.I.P.		+19.2	+15.4	+23.1	+11.5	+11.5	+11.5	-3.8	0.0	0.0	0.0	0.0
Blade area/one leaf	P.I.	74.5	79.6	86.9	99.5	100.0	97.1	92.3	86.9	82.6	82.6	82.6	82.6
	P.I.P.		+5.1	+7.3	+12.6	+0.5	-2.9	-4.8	-5.4	-4.3	-4.3	±0.0	±0.0

P.I. = Percentage increase . P.I.P. = Periodic increase percentage

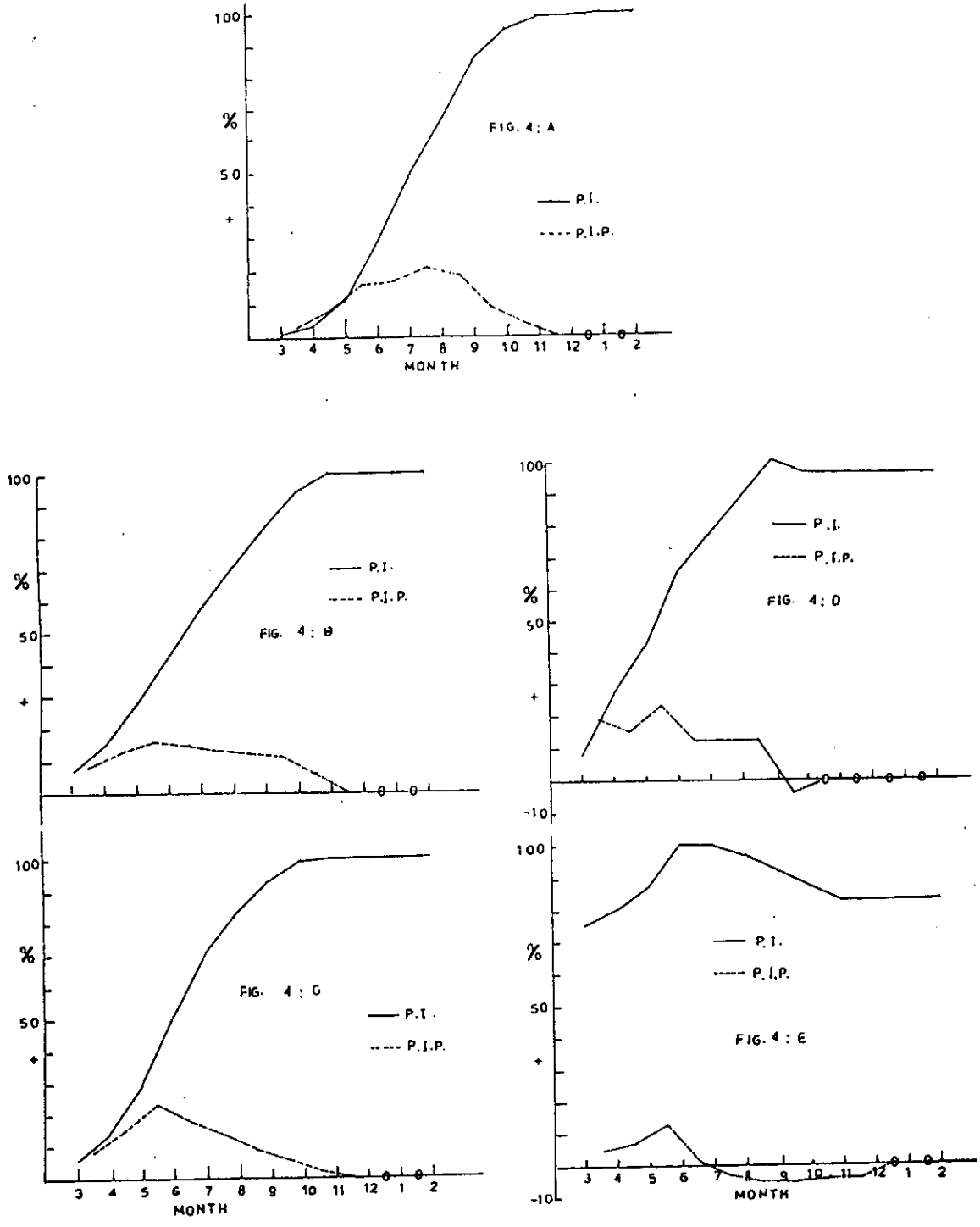


Fig (4): Seasonal changes in *Philodendron erubescens* growth in terms of % increase (P.I.) and periodic increase % (P.I.P.) as related to the maximum values attained during the growth periods of: (A) Stem length; (B) Leaf No / plant; (C) Whole plant leaf area/plant; (D) Mean of internode length; (E) Blade area/one leaf. (Season, 1988-1989).

3: March; 4: April; 5: May; 6: June; 7: July; 8: August; 9: September; 10: October; 11: November; 12: December; 1: January; 2: February

The different foregoing results of the growth behaviour and seasonal changes in growth criteria of the four tested species may be discussed on the following bases:

i) The dormant or rest state in many members of araceous plants was also noticed by many workers **(Nagao, 1979; Ray, 1987 a,b&c, 1988 and Herrera, 1989).**

ii) **Blanc (1986)** stated that the morphological characters and growth behaviour of ***Araceae*** plants were controlled by vertical or horozontal planes and the prevailing environmental conditions such as seasonal stress (dry or cold season and low light intensity under the canopy.

iii) **Steinitz and Hagiladi (1987)** mentioned that the growing methods (hanging or climbing) of ***Philodendron scondens*** and ***Epipremnum aureum***, i.e. ***(Scindapsus aureus)***, affected their growth behaviour and changes their growth criteria. The same workers noticed also that aerial roots formation was judged by the growing methods. They also suggested that plants of ***Araceae*** display thigmomorphogenetic responses induced by the contact of the support.

iv) From this results and the foregoing information it was suggested that our four tested species display thermomorphogenetic responses induced by the contact of aerial roots and stems with the adjacent surface of the support, in addition to the direction of relatively higher light intensity and gravity, otherwise exerted tropisms or nastic movements.

Experiment II

Stimulation of Lateral Branch Formation and Break of Apical Dominance

As mentioned before most of ***Araceae*** plant species exhibit complete apical dominance phenomenon, as the main axes grow solitary and continuously without any lateral branch formation. The removal of terminal bud permit the formation and development of only one lateral branch from the most nearest terminal axillary bud to the wounded decapitated terminal portion. The developing axillary bud may be considered as shoot or axes renewal. This conclusion was detected from a preliminary experiment which was carried out before any treatments. It must be mentioned from this work during such preliminary experiment that the removal of terminal bud of ***Scindapsus aureus*** and different

:ested ***Philodendron*** species that the axes renewal and development in ***Scindapsus aureus*** ***v***as resulted from the axillary bud of foliage bladded leaf (photo 23) However, the ieveloping axillary bud of ***Philodendron*** species arised from the axillary bud of the scaly nembranous bladeless sheath (see Phots. 23 & 24). Of course this occurred after the :emoval of the terminal bud of different tested species of both genera. According to this finding, the developing of axillary bud after the removal of terminal one in ***Scindapsus aureus*** may be considered as proleptic shoot, as the proleptic shoots developed from a bud that has rested **(Ray, 1986).** It must be mentioned that all of the axillary buds of ***"Pothas"*** in any leaf possitions are in complete dormant or rest state. This rest state is broken in only one axillary bud, the most nearest one to the absence of terminal one. On the other hand, the developing axillary bud in different ***Philodendron*** species which resulted from the scale membranous bladeless sheath may be considered as sylleptic shoot, as it is resulted from axillary bud of the sheathed bladeless leaf (Photos. 23 and 24). It must be mentioned again, from our observations during the preliminary experiment, that the removal of the terminal bud stimulated the development of only one axillary bud for renewal the axes of either ***Scindapsus aureus or Philodendron species,*** and all of axillary bud are in complete rest state in the presence of terminal one.

As mentioned before in material & methods, for stimulation of lateral branch formation two groups of treatments were carried out separately. The first one. **(Experiment II,a season, 1989)** included ***Scindapsus aureus*** only, while the second group of treatments. **(Experiment II,b - season, 1990)** included ***Scindapsus aereus, Philodendron scandens, P.bipinnatifidum and P. erubescens,*** as the number of available growing plants of ***Philodendron*** species were not enough to carry out both experiments.

(Experiment II,a-seasen,1989)

Effect of GA_3 on the lateral Branch Formation of Scindapsus aureus.

As mentioned before this experiment was carried out on ***Scindapsus aureus*** to get some clue information about the effect of GA_3 at the rates of 0,1,2 or 4 ppm. applied directly on the axillary buds by means of moisted absorbent cotton in the presence

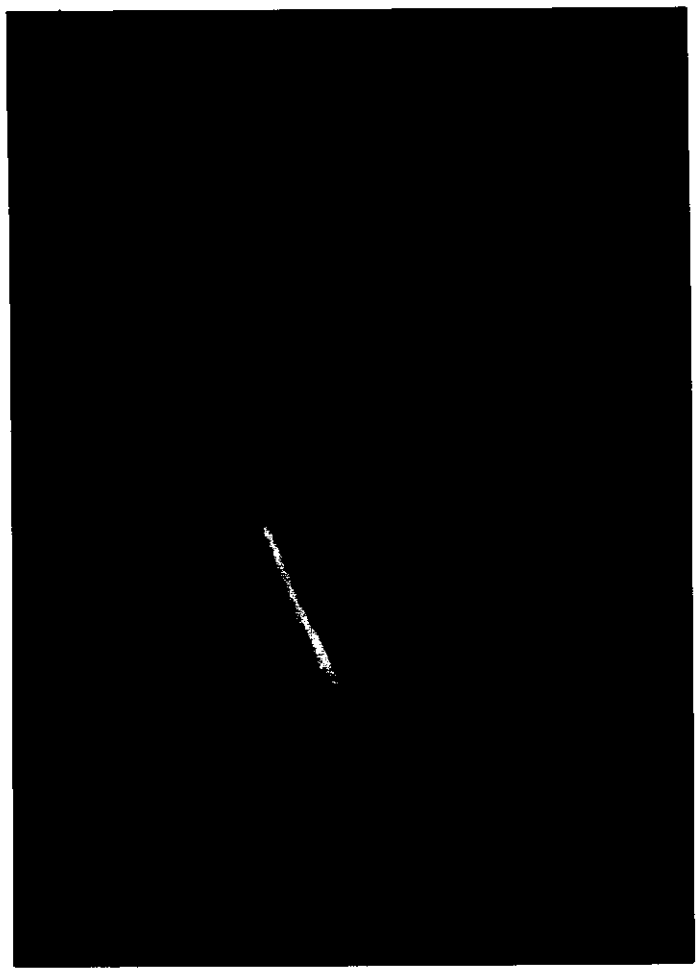


Photo. (22) (*2):

Early stage of developing lateral branch formation in ***Scindapsus aureus***, as a result of foliage leaf axillary bud activity after the removal of terminal bud (preliminary experiment).

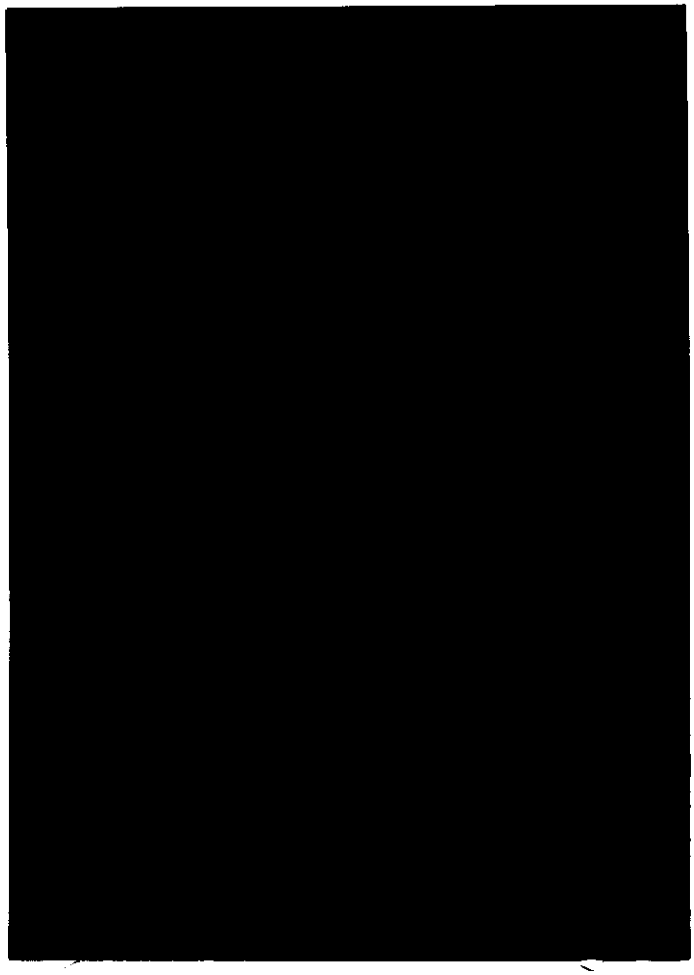


Photo. (23)(* 1):

Terminal portion of ***Philodendron scandens*** showing the membranious bladeless scale protective sheath, and the developed sympodial or sylleptic shoot renewal as a result of axillary foliage sledded leaf bud as the other axillary bladeless scale bud is in complete resting stage resulting from the presence of terminal area (see the next photo. (24).

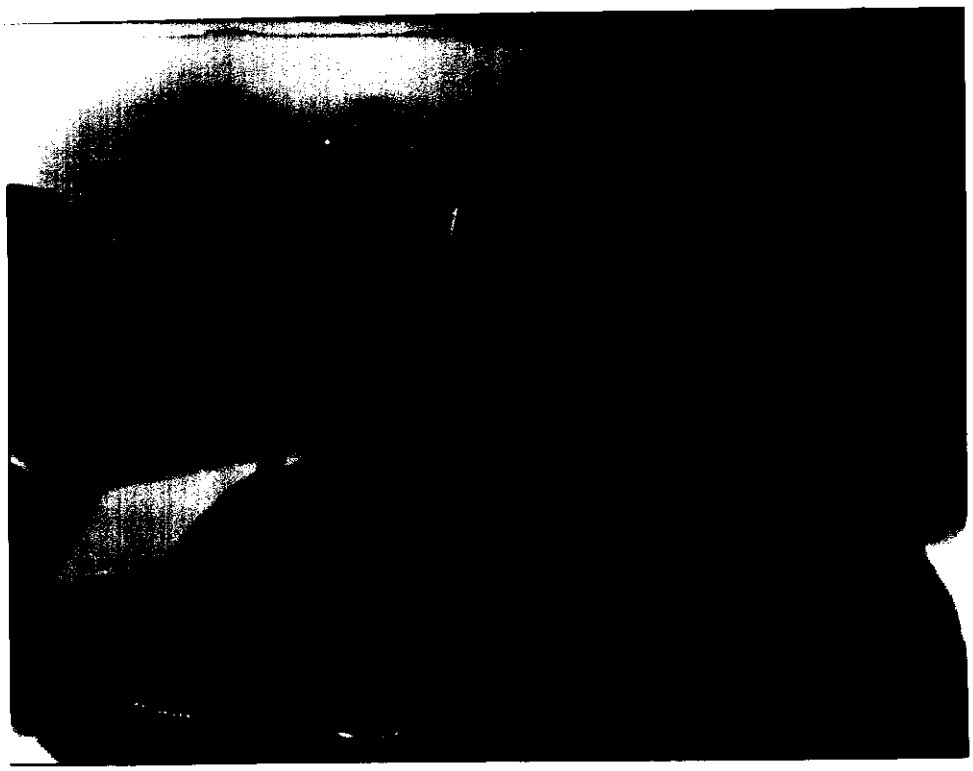


Photo. (24) (* 1):

Developing lateral branch resulted from axillary bud of the membranious bladeless scale sheath in ***Philodendron scandens*** after the removal of terminal bud.See also the died sheath organ as this sheath is not permanent.

or absence of terminal bud. The specific chosen GA_3 concentration was applied at 0.5 ml. on the cotton three times with two days interval during June 7,9 and 11of 1989. The following criteria were recorded every two weeks till 12 weeks after the end of the last application:

a) General observations.

b) The number of lateral branches/plant.

c) The number of new formed leaves.

a) General observations

It could be concluded from this work the following conclusions:

i) The presence of terminal bud resulted in the complete rest state of all different axillary buds positions in plants treated with 0 ppm.GA_3. At the same time the absence of terminal bud of 0 ppm GA_3 treated plants resulted only for the development of one axillary bud, the most nearest one to the wounded terminal one.

ii) One, two or four ppm. of GA_3 stimulated more than one lateral branch if the terminal bud was absent and the most effective one was the four ppm.

iii) The appearance of lateral branch begin at the base of different decapitated GA_3 treated plants and at the terminal portion from the second period of after the treatment and continously increased till 12 weeks.

iv) The first developed leaf on the branches of the decapitated GA_3 treated plants is the prophyll in which the blade is missing and this finding was not recorded before in ***Scindapsus aureus,*** see photos 25,26,27, &28. The cataphylls or reduced leaves appeared after the prophyll one as the blade appeared and the blade is longer in each successive leaf until the normal leaf size was reached. Thus there is a gradual transition from the smallest leaf to the normal leaf, with intermediate forms showing a full graduation between the two extremes. This finding was not recorded before in ***Scindapsus aureus.***

v) It must be mentioned here that GA_3 regulates and control the apical dominance phenomenon in ***Scindapsus aureus,*** especially if the terminal bud was absent and that resulted in the association of proleptic prophyll and cataphylls appearance. The cataphylls or

reduced leaves which follow under GA_3 treated plants will be called"proleptic mesophylls" (see photos from (25 till 28).

b) The number of lateral branch formation (Table,6,a)

Under the conditions of this factorial experiment more than one factors affecting the lateral branch initiation,which resulted from the break of apical dominance. These factors under the conditions of this experiment are: The presence or absence of the terminal bud,the application of different GA_3 rates, and finally the period after the end of treatment application. To clarify the collecting data, the discussion was carried out on the basis of statistical analysis by using factorial method in which the effect of every factor alone, beside their probable interactions were discussed. It must be mentioned that any emerged axillary bud at any leaf position with the length of about one cm. only was considered as new formed branch. Again, it must be mentioned that all of the axillary buds at any leaf position are in complete rest or dormant state in ***Scindapsus aureus*** without any visible emergency,in the presence or attached terminal bud. It was considered the apical dominance in many of ***Araceae*** plant species from the strong type. At any way the following conclusion may be detected :

i) As a general,and irrespective to any other factor, the removal of terminal bud permets the formation of only one new lateral branch. This is a fact, and we expected this result, as there was no formed branch in the presence of attached terminal bud without any other treatment. However, one branch only was emerged when terminal bud was removed without any other treatments. This indicates that the apical dominance in ***Scindapsus aureus*** from the strong type.

Table (6,a&b): Effect of the different rates of GA_3 in the presence or absence of terminal bud on the formiation of (a) new formed branches; and (b)new formed leaves.

(a) No. of new formed branches

GA3 ppm (G)	Apical budded group(A)weeks after the end of treatments							Disapical budded group(A)week after the end of treatments							Total mean (G)	Mean of periods(P*G) weeks after the end of treatments						Total mean (G)
	2	4	6	8	10	12	mean	2	4	6	8	10	12	mean		2	4	6	8	10	12	
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.0	1.0	1.0	1.0	1.0	0.9	0.5	0.2	0.5	0.5	0.5	0.5	0.5	0.5
1	0.0	0.1	0.2	0.7	1.0	1.3	0.6	1.0	1.3	1.5	1.9	2.6	3.9	2.0	1.3	0.5	0.7	0.9	1.3	1.8	2.6	1.3
2	0.0	0.2	0.3	1.0	1.2	1.7	0.7	2.3	3.3	3.9	4.9	5.3	6.8	4.4	2.6	1.2	1.8	2.1	3.0	3.3	4.3	2.6
4	0.2	0.5	0.9	2.2	2.8	2.9	1.6	3.9	5.3	6.4	7.8	9.5	10.0	7.2	4.5	2.1	2.9	3.7	5.0	6.2	6.5	4.4
Mean of P*A	0.1	0.2	0.4	1.0	1.3	1.5	0.7	1.8	2.7	3.2	3.9	4.6	9.4	3.6	1.6	1.0	1.5	1.8	2.5	3.0	3.5	2.2

L.S.D. 5%
A = 0.06 G = 0.08 P = 0.1 P*G= 0.2
P*A= 0.13 G*A= 0.11 G*P*A= 0.28

(b) No. of new formed leaves.

0	2.0	2.9	5.7	6.9	8.1	10.2	6.0	0.0	1.0	3.4	7.2	8.9	10.3	5.1	5.6	1.0	2.0	4.6	7.1	8.5	10.3	5.6
1	2.8	3.1	6.2	7.8	9.3	11.4	6.8	0.0	1.8	3.9	8.9	10.5	12.4	6.3	6.6	1.4	2.5	5.1	8.4	9.9	11.9	6.5
2	2.9	3.7	6.9	8.1	10.4	12.4	7.4	0.0	2.9	5.5	9.3	12.7	16.8	7.9	7.7	1.5	3.3	6.2	8.7	11.6	14.6	7.7
4	3.5	4.3	7.5	8.5	11.3	13.3	8.1	0.0	3.5	6.7	10.4	15.9	24.6	10.2	9.2	1.8	3.9	7.1	9.5	13.6	19.0	9.2
Mean of P*A	2.8	3.5	6.6	7.8	9.8	11.8		0.0	2.3	4.9	9.0	12.0	16.0	7.4		1.4	2.9	5.8	8.4	10.9	14.0	

L.S.D. 5% A=0.04 G=0.06 P=0.1 P*G=0.13 P*A=0.1 G*A=0.11 G*P*A=0.19

Photo. (25) (*1):

Basal portion of ***Scindapsus aereus*** showing the great formations of lateral branches after 6 weeks from the last treatment with 4 ppm GA_3 in the absence of terminal bud.See also prophyll (leaf missing blade at the base of the lateral branch,and the reduced cataphylls (Ex.p II,a).

Photo. (26) (*1):

Four ppm. GA_3 treated ***Scindapsus aureas*** decapitated plant basal portion showing as in the above mentioned Photo. (25) many developed lateral branches after 8 weeks from the treatment See the prophylls and the cataphylls mesophylls. (Exp.II,a).

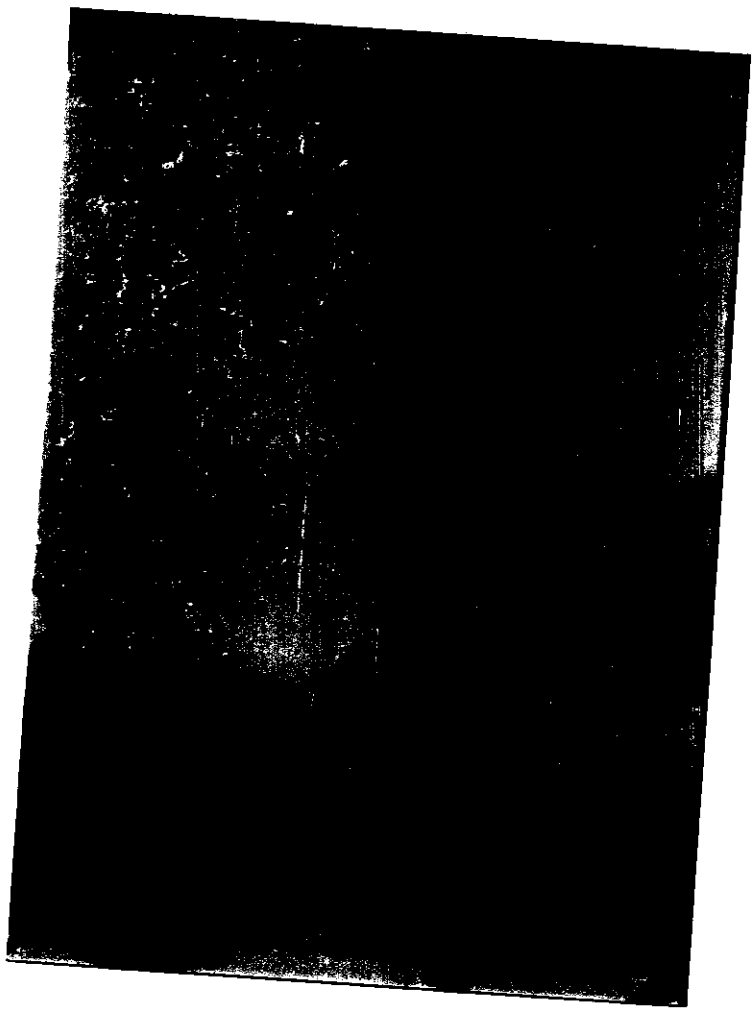
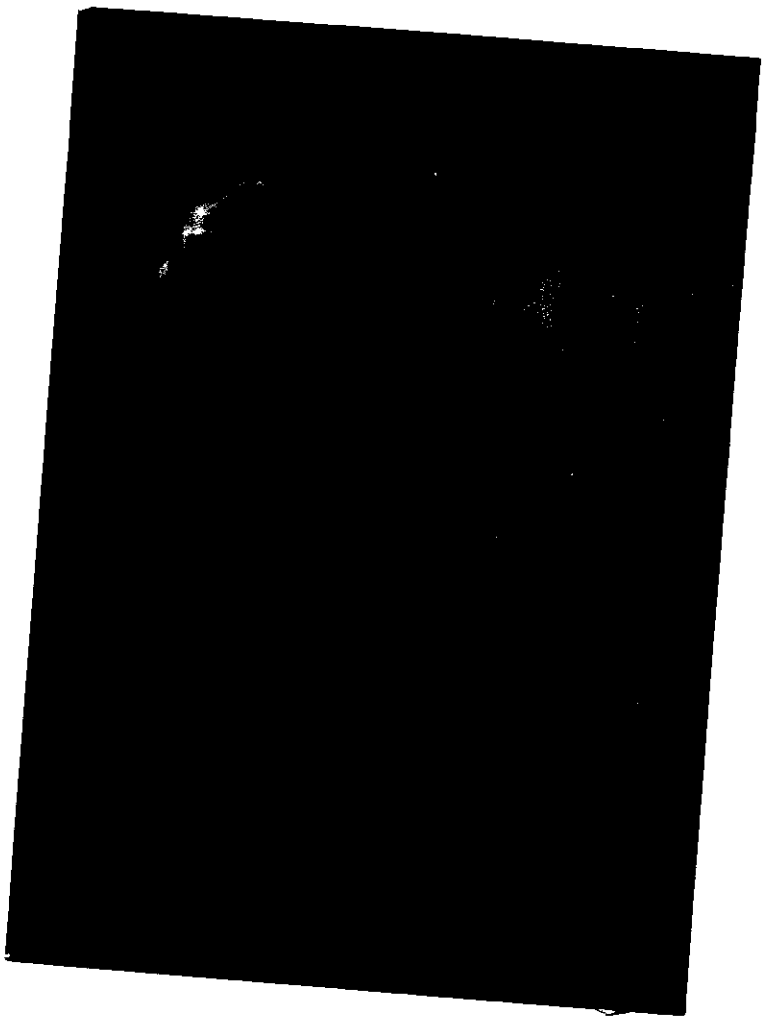


Photo. (27)(* 1):

Developing lateral branch of ***Scindapsus aureus*** resulted from the removal of terminal bud and treatment with 4 ppm.GA_3 after 10 weeks from the treatment. See the prophyll (bladeless, i.e. the first formed leaf on the base of lateral branch. See also proleptic cataphyll mesophylls. (EXp.II,a).



hoto. (28) (* 0.25):

Terminal portion of ***Scindapsus aureus*** plant showing the effect of terminal bud removal associated with GA_3 application at the rate of 4 ppm. Showing two terminal well developed lateral branches after 12 weeks from the treatment (Experiment II,a).

ii) Also, as a general,and irrespective to any other factor, the application of GA_3 at different rates under the condition of this experiment and the used method of GA_3 application, enhances the formations of lateral branches. The higher the rate of GA_3 application, the higher the formation of lateral branches was gained.It must be mentioned here that all of the axillary buds were emerged in decapitated plants treated with 4 ppm GA_3 after 10 to 12 weeks from the end of the treatment. However, many of these new formed lateral branches under the foregoing treatment were developed to a short extend without normal leaf formation. It was considered this reduced branch as none functional branch. However, many other branches were developed greatly especially the terminal formed lateral branches.

iii) The emergency of lateral branches seemed to be more or less increased with plant age, to be reached into its maximum rates after the end of 12 weeks from the end of the treatments. This could be discussed on the basis that the break of apical dominance was did not occur on all axillary buds at one or specific time as the response of axillary bud to the stimulatory effect may depend on the possition of such axillary bud on the main axes.

iv) With regard to the interaction effect of the role of terminal bud presence or absence and GA_3 treatments, it could be concluded that the stimulatory effect of GA_3 on the rate of lateral branch formation increased in the absence of terminal bud. This stimulatory effect increased with increasing the used rates of GA_3. In this connection, it could be concluded that GA_3 regulates the role of terminal bud presence or absence on apical dominance phenomenon. In addition, both of terminal bud presence or absence, and the treatment of GA_3 affected the degree of apical dominance phenomenon. In other words, the attached terminal bud forbid completely or partially the formation of lateral branch according to the used rate of GA_3, as the apical dominance was in its complete state under the presence of terminal bud of zero GA_3 treated plants.

v) It could be concluded finally that, the application of GA_3 at the rate of 4 ppm breaks completely the apical dominance of decapitated ***Sindapsus aureus*** plants after 10 to 12 weeks from the treatment.

The different previous results may be discussed on the basis that, the large body of conflicting data which have been amassed over the years by many workers, suggests that control of lateral shoot growth probably involves complex interactions between nutritional factors, anatomical structure stage of development, growth promoters and growth inhibitors. The relative importance of these factors may vary both with the aspect of apical dominance studied and the conditions under which the investigations are carried out (**Woolley and Wareing, 1972a).**

C) Number of new formed leaves (Table 6,b)

Before discussing the effect of different factors of this experiment on the formation of leaves, it must be mentioned the defination of the wide effect of apical dominance which descriped by **Woolley and Wareing (1972a).** They concluded that apical dominance is a general term which is used to denote the corelative influence of the apex or dominant shoot, on the growth and orientation of lateral organs such as, buds, leafy shoots, stolons, branches and leaves (see also the review of **Phillips, 1969).**

According to the forementioned difinition the study was extended to explain the effect of the different factors under the conditions of this experiment on the whole number of new formed leaves per one plant either on the main axes or on the new formed branches if present. But it must be mentioned that most of the new formed leaves on the lateral branches were the cataphyl or mesophyll reduced type, and many were from the prophyll bladeless leaves type, especially those formed in the presence of terminal buds.

It could be concluded from the available data that the number of new formed leaves was correlated with the number of new branch formation. The number of leaves during the first period of growth (2 weeks after treatment) was nill when the terminal bud was removed, as the new emerged leaves on the lateral branches was not visible. The new formed branches were in their juvenile stage and all of the new formed full expanded leaves were not observed. This affected greatly the number of new formed leaves on the decapitated GA_3 treated plants. However different factors of this experiment such as the presence or absence of terminal bud, different rates of GA_3, and the treated plant age affected signifincantly the resulted new formed leaves.

It could be concluded that, the new formed leaves of GA_3 decapitated plants ncreased gradually from the second period of growth (4 weeks after treatment) till the end of the experiment. In addition, the higher the rate of GA_3 application the higher the rate of new formed leaves was gained, either on the capitated or decapitated plants. This effect of GA_3 may be discussed on the basis that GA_3 stimulates main axes growth of the capitated plant group or lateral branches of the decapitated one.

It could be mentioned from the above mentioned results that both of terminal bud presence or absence and different applied rates of GA_3 affected the new formed leaves in ***Scindapsus aureus***. The removal of terminal bud delays the formation of new formed leaves. Moreover plant age affected the formatien of new leaves.

Experiment II,b (season 1990)

Effect of GA_3,BA and pp_{333} on lateral Branch Formatien of Scindapsus aureus,Philodendron scandens,P.bipinnatifidum and P. erubescens.

a) Scindapsus aureus (Table 7,a,b&c)

The data of Table (7,a,b&c) indicated the following conclusions:

i) Treatments with either GA_3, BA or PP_{333} affected the growth behaviours of ***Scindapsus auras*** in the terms of axes length, lateral branch formatiens and leaves number/plant. It could be concluded that GA_3 or BA at the rate of 100 ppm. seemed to stimulate the axes length and leaves formation. However, PP_{333} at the very low concentration, i.e. 5ppm. Only retarded axes length, but stimulates the leaves formations. It may be concluded that the highest stimulatory effect on leaves formation was gained by the application of BA.

ii) It could be concluded that different treatments affected significantly the lateral branch formation. However, different treatments seemed to have very weak effect on the break of apical dominance phenomenon, as the number of lateral branch formation was very low, and not developed into functional branches.

iii) It may be concluded that different treatments seemed to regulate the rates of axes length, lateral branch formation and leaves formations during different periods of growth

Table(7a,b&c): Response of *Scindapsus aureus* to the foliar spray with some growth regulators in the terms of axes length, lateral branch formation and number of leaves/plant

(a) Axes length/plant

Treatment		Axes length (cm) weeks after treatments									% increase as related to the maximum after 14 weeks							
Substa-ance	concent-ration	start	2	4	6	8	10	12	14	mean	start	2	4	6	8	10	12	14
Control	0.0	3.6	4.4	5.3	9.0	10.4	15.5	17.7	20.5	10.8	17.6	21.5	25.9	43.9	50.7	75.6	86.3	100
GA3	100	3.6	4.7	5.7	9.5	11.5	20.2	32.8	39.5	15.9	9.1	11.9	14.4	24.1	29.1	51.1	83.0	100
BA	100	3.6	7.2	8.5	13.9	14.9	21.5	24.5	30.3	15.6	11.9	23.8	28.1	45.9	49.2	71.0	80.9	100
PP333	5	3.6	4.5	5.1	8.2	9.1	13.3	16.1	18.8	9.8	19.1	23.9	27.1	43.6	48.4	70.7	85.6	100
Mean		3.6	5.2	6.2	8.1	11.5	17.6	22.9	2.73	10.3	14.4	20.3	23.9	39.4	44.4	67.1	84.0	100

L.S.D. 5% Treatmant (T): 0.1 Period (P): 0.1 T*P : 0.2

(b) No. of lateral branch/plant.

Control	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GA3	100	0.0	0.3	0.3	0.6	0.6	0.6	0.8	0.8	0.5	0.0	37.5	37.5	75.0	75.0	75.0	100	100
BA	100	0.0	0.0	0.3	0.3	0.3	0.3	0.6	0.6	0.2	0.0	0.0	50.0	50.0	50.0	50.0	100	100
PP333	5	0.0	0.3	0.3	0.3	0.6	0.6	0.6	0.8	0.4	0.0	37.5	37.5	37.5	75.0	75.0	75.0	100
Mean		0.0	0.2	2.0	0.3	0.4	0.4	0.5	0.6	0.3	0.0	18.8	31.3	40.6	50.0	50.0	68.8	75.0

L.S.D. 5% Treatmant (T): 0.1 Period (P): 0.1 T*P : 0.2

(c) No. of leaves/plant

Control	0	3.5	3.7	4.5	5.0	5.5	5.8	7.7	10.5	5.8	33.3	35.2	42.9	47.6	52.4	55.2	73.3	100
GA3	100	3.5	4.0	4.5	4.8	6.2	6.5	9.5	11.5	5.9	30.4	34.8	39.1	41.7	53.9	56.5	82.6	100
BA	100	3.5	4.0	5.5	5.8	7.5	8.5	11.5	14.5	7.6	24.1	27.6	39.9	40.0	51.7	58.6	79.3	100
PP333	5	3.5	4.0	4.3	5.3	6.3	7.5	9.8	11.5	6.5	30.4	34.8	37.4	46.1	54.8	65.2	85.2	100
Mean		3.5	3.9	4.7	5.2	6.4	7.1	9.6	12.0	6.5	29.6	33.1	39.8	43.9	53.2	58.9	80.1	100

L.S.D. 5% Treatmant (T): 0.2 Period (P): 0.3 T*P : 0.5

*) ***Philodendron scandens*** (Table 8, a, b & c)

The effect of the tested treatments ***P.scandens*** seemed to be more or less the same as ***Sindapsus aureus***. The best stimulatory effect on axes length, leaf formations and lateral branch formation was gained by the application of BA at the rate of 100 ppm.and GA_3 at the rate of 100. It may concluded that BA seemed to have partial effect on apical dominance phenomenon more than other treatments.

c) ***Philodendron bipinnatifidum*** (Table 9, a, b & c)

It may be concluded , from the available data, that this species showed the same trend as mention before of both forementioned species.

d) Philodendron erubesens (Table 10, a, b & c)

The response of this species was more or less similar to those discussed before.

The differant obtained results of **Experiment II a&b** may be discussed on the following basis:

1) It must be mentioned that some correlative actions involve the prevention of growth-this is called correlative inhibition, perhaps the best-known expample is apical dominance. The intact apex prevents the growth of axillary buds lower down the stem. Apical dominance is, usually, lost when the shoot tip is removed (Experiment II,a).

Apical dominance is a general term which is used to denote the correlative influence of the apex or dominant shoot, on the growth and orientation of lateral organs such as buds, leafy shoots, stolons, branches and leaves **(Phillips, 1969 and Woolley & Wareing, 1972, a,b&c).** According to this definitian the formation of leaves by ***Scindapsus aureus*** may be involved under apical dominance phenomenon. Thus, our study was extended to include the formation of leaves under the conditions of the different treatments.

2) Apical dominance may be classified into two categories, the strong and the weak ones, with gradual in a descending order from the strongest or the top of apical dominance into the weakest one. The type of apical dominance on axillary buds of ***Scindapsus aureus*** is from the strongest one as in other most members of ***Araceae*** plants. It must be mentioned that in the absence of the apical bud, active growth begins in only one lateral bud of the control treated plants. However, in a short time, the new formed lateral branch

Table(8a,b&c): Response of *Philodendron scandens* to the foliar spray with some growth regulator in the terms of axes length, branch formation and number of leaves/plant.

(a)Axes length/plant

Treatment		Axes length (cm) weeks after treatments									% increase as related to the maximum after 14 weeks								
Substance	concentration	start	2	4	6	8	10	12	14	mean (T)	start	2	4	6	8	10	12	14	16
Control	0	11.5	11.5	15.0	16.5	17.0	21.1	22.2	26.2	17.6	43.9	43.9	48.9	57.3	63.0	64.9	80.5	84.7	100
GA3	100	11.4	13.5	16.3	17.4	18.2	22.1	24.5	30.1	19.2	37.9	37.9	44.9	54.2	57.8	60.5	73.4	81.4	100
BA	100	11.5	15.6	19.2	22.4	24.5	27.3	30.3	33.4	23.0	34.4	34.4	46.7	57.5	67.1	73.4	81.7	90.7	100
PP333	5	11.4	13.0	15.3	16.2	16.9	19.6	22.8	24.2	17.4	47.0	47.1	53.7	63.2	66.9	69.8	81.0	94.2	100
Mean (P)		11.5	13.4	16.5	18.1	19.2	22.5	25.0	28.5	19.3	40.8	40.8	47.3	58.1	63.7	67.2	79.2	87.9	100

L.S.D, 5% Treatmant (T): 0.06 Period (P): 0.08 T*P : 0.16

No. of lateral branch/plant

Control	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GA3	100	0.0	0.0	0.0	0.2	0.3	1.2	1.3	1.5	0.6	0.0	0.0	0.0	0.0	13.3	20.0	80.0	86.7	100
BA	100	0.0	0.2	0.3	1.5	1.5	2.0	2.6	2.6	1.3	0.0	0.0	7.7	11.5	57.7	57.7	76.9	100	100
PP333	5	0.0	0.2	0.3	1.3	1.5	2.2	2.2	2.2	1.2	0.0	0.0	9.1	13.6	59.1	68.2	100	100	100
Mean (P)		0.0	0.1	0.2	0.8	0.8	1.1	1.5	1.6	0.8	0.0	0.0	4.2	6.3	32.6	36.5	64.3	71.7	75.0

L.S.D. 5% Treatmant (T): 0.01 Period (P): 0.02 T*P : 0.10

(c) No. of leaves/plant.

Control	0	6.0	6.3	6.8	7.3	7.8	9.5	10.0	11.0	8.1	54.5	54.5	57.3	61.8	66.4	70.9	86.4	90.9	100
GA3	100	6.3	7.0	9.3	10.0	11.0	13.0	14.0	16.5	10.9	38.2	38.2	42.4	56.4	60.6	66.7	78.8	84.8	100
BA	100	6.2	8.7	9.7	10.2	11.0	12.5	13.2	16.5	11.0	37.6	37.6	52.7	58.8	61.8	66.7	75.8	80.0	100
PP333	5	6.2	7.5	7.7	8.5	9.2	9.5	11.2	12.0	9.0	51.7	51.7	62.5	64.2	70.8	76.7	79.2	93.3	100
Mean (P)		6.2	7.4	8.4	9.0	9.8	11.1	12.1	14.0	9.8	45.5	45.5	53.7	60.3	64.9	70.3	80.1	87.3	100

L.S.D. 5% Treatmant (T): 0.11 Period (P): 0.16 T*P : 0.32

Table(9a,b&c): Response *of P.bipinnatifidum* to the foliar of spray with some growth regulators in the terms of axes length,branch formation and number of leaves.

(a)Axes stem length

Treatment		Axes length (cm) weeks after treatments									% of the new formed leaf as related to the begins							
Substance	concentration	start	2	4	6	8	10	12	14	mean	start	2	4	6	8	10	12	14
Control	0.0	2.5	2.7	3.1	6.5	9.2	10.4	13.4	14.1	7.7	17.7	19.1	22	46.1	65.3	73.8	95.0	100
GA3	100.0	2.5	2.7	3.8	7.0	10.9	11.6	12.4	13.6	8.1	18.4	19.4	27.9	51.5	80.1	85.3	91.2	100
BA	100.0	2.5	2.7	3.4	7.5	10.4	11.9	12.0	12.7	7.9	19.7	21.3	26.8	59.1	81.9	93.7	94.5	100
PP333	5.0	2.5	2.6	2.8	5.5	7.8	10.0	10.4	11.2	6.6	22.3	23.2	25	49.1	69.6	89.3	92.9	100
Mean		2.5	2.7	3.3	6.6	9.6	11.0	12.1	12.9	7.6	19.5	20.8	25.4	51.5	74.2	85.5	93.4	100

L.S.D. 5% Treatment (T) : 0.2 Periods (P) : 0.2 T*P : 0.4

(b) No. of lateral branch.

Control	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GA3	100	0.0	0.2	0.3	0.5	0.6	1.0	1.4	1.4	0.7	0.0	7.0	21.4	35.7	42.9	71.4	100	100
BA	100	0.0	0.2	0.3	0.6	0.7	1.3	1.6	1.7	0.8	0.0	11.8	17.6	35.3	41.2	76.5	94.1	100
PP333	5	0.0	0.4	0.5	1.0	1.3	2.0	2.3	2.5	1.3	0.0	16.0	20	40	52	80	92.0	100
Mean		0.0	0.2	0.3	0.5	0.7	1.1	1.3	1.4	0.7	0.0	8.7	14.8	27.8	34.0	57.0	71.5	75.0

L.S.D. 5% Treatment (T) : 0.1 Periods (P) : 0.1 T*P : 0.2

(C) Leaf No.

Control	0.0	3.4	3.5	4.2	4.5	4.6	5.0	5.1	6.0	4.5	56.7	58.3	70	75	76.6	83.3	85	100
GA3	100	3.4	3.7	4.4	5.2	5.3	5.5	5.8	6.4	5.0	53.1	57.8	68.8	81.3	82.8	85.9	90.6	100
BA	100	3.2	3.9	4.5	5.2	5.5	5.8	6.7	6.8	5.2	47.1	57.4	66.2	76.5	80.8	85.2	98.5	100
PP333	5	3.2	3.3	3.8	4.0	4.3	5.2	5.3	5.5	4.3	58.2	60	69.1	72.7	78.2	94.5	96.4	100
Mean		3.3	3.6	4.2	4.7	4.9	5.4	5.7	6.2	4.8	53.8	58.4	68.5	76.4	79.6	87.2	92.6	100

L.S.D. 5% : between treatments (T) = 0.3 between periods (P) = 0.4 between T*P = 0.8

Table(10,a,b&c): Response of *P.erubescens* to the foliar spray with some growth regulators in the terms of axes length, lateral branch formation and number of leaves/plant

Axes length/plant

Treatment		axes length (cm) weeks after treatments.									% increase as related to the maximum after 14 weeks.							
Substa-ance	concent-ration	start	2	4	6	8	10	12	14	mean (T)	start	2	4	6	8	10	12	14
Control	0.0	1.5	1.8	2.6	5.3	6.2	8.6	10.1	12.1		12.4	14.9	21.5	43.8	51.2	71.1	83.4	100
GA3	100	1.5	2.1	3.2	5.3	6.1	8.5	10.6	12.9		11.6	16.3	24.8	41.1	47.3	65.9	82.1	100
BA	100	1.5	2.5	3.5	7.4	8.4	11.2	13.2	15.6		9.6	16.0	22.4	47.4	53.8	71.8	84.6	100
PP333	5	1.5	2.0	2.4	4.2	5.3	6.2	8.6	9.9		15.2	20.2	24.2	42.4	53.5	62.6	86.9	100
Mean		1.5	2.1	2.9	5.6	6.5	8.6	10.6	12.6		12.2	16.9	23.2	43.7	51.5	67.9	84.3	100

L.S.D. 5% Treatmant (T): 0.03 Period (P): 0.05 T*P : 0.09

(b) No. of lateral branch/plant.

Control	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	100
GA3	100	0.0	0.0	0.0	0.2	0.3	0.5	0.6	0.6			0.0	0.0	33	50	83.3	100	100
BA	100	0.0	0.0	0.0	0.3	0.6	0.7	1.3	1.6			0.0	0.0	18	37.5	43.8	81.3	100
PP333	5	0.0	0.2	0.4	1.0	1.3	2.3	2.5	2.5			8	16	40	52	92	100	100
Mean		0.0	0.1	0.1	0.4	0.6	0.9	1.1	1.2			2	4	22.8	34.9	54.8	70.3	100

L.S.D. 5% Treatmant (T): 0.01 Period (P): 0.02 T*P : 0.03

(c) No. of lateral branch/plant.

Control	0	3.0	3.1	3.3	3.5	3.6	3.8	4.0	5.0		60	62	66	70	72	76	80	100
GA3	100	3.0	3.5	3.8	4.0	4.5	4.6	4.8	5.3		56.6	66	71.7	75.5	84.9	86.8	90.6	100
BA	100	3.0	3.5	4.6	4.8	5.0	5.3	5.5	5.8		51.7	60.3	79.3	82.8	86.2	91.4	94.8	100
PP333	5	3.0	3.3	3.5	3.6	4.0	4.3	4.5	4.8		62.5	68.8	72.9	75	83.3	89.6	93.8	100
Mean		3	3.4	3.8	3.9	4.3	4.5	4.7	5.2		57.7	64.3	72.5	75.8	81.6	85.9	89.8	100

L.S.D. 5% Treatmant (T): 0.01 Period (P): 0.02 T*P : 0.03

earest the apex well established dominance over the remaining buds and cause them to ecome inactive again (see the results of decapitative control treatment of **Experiment I,a)**. The same conclusion was also detected by **Devlin & Witham (1983).**

Very poor lateral branch formation in the capitated of the four tested plant species as gained in spite of the treatmets with different growth regulators. This may be discussed n the bases of the very strong type of apical dominance in such plants.

3) The large body of conflicting data which has been amassed over the years uggests that control of lateral shoot growth probably involves complex interactions etween nutritional factors, anatomical structure, stage of development, growth promoters nd growth inhibitors; the relative importance of these factors may vary both with the spect of apical dominance studied and the conditions (environmental ones) under which the nvestigations were carried out. Although, the problem of apical bud dominance did not lend tself to easy solutien, it did cause a great deal of speculation in the Botanical world. Many heories were proposed varying degrees of acceptance. These theories have been receiving an increasing amount of criticism,as the apical dominance is complecated physiological phenomenon **(Devlin &Witham, 1983).**

4) From the bulk of literature apical dominance seemed to be an expressions by a delicate balance between auxins (which formed by apical bud), gibberellins and root-produced cytokinins. On this basis, the exogenous applications of different GA_3 rates on the decapitated ***Scindapsus aureus*** plants may regulate such balance leading to the more release of functional lateral branches formations **(Experiment II,a)**. However, the applications of 100 ppm.GA_3 on the four tested plant species seemed to have the lowest effect on lateral branch formation. This effect was very weak and the very low amounts of the developing formed buds hase very limited elongated amounts, thus we consideredl it as non-functional branches. **(Experinent II,b)**.

5) Finally it was recomnended to use GA_3 at 4 ppm. applied directly on the axillary buds of the decapitated ***Scindopsus aureus.*** However, it was recommended also that the study must be continued during the future if the question is to be fully answered.

6) The forementioned information were obtained on the basis of those reported by a ›t of workers among them: **(Wickson & Thimann, 1958; Sachs & Tluimenn, 1964; Vareing & Nasr, 1961; Smith & Wareing, 1964; Longman, 1968; Miginiac, 1971; Kumar & Wareing, 1972; Catalona & Hill;1969; Ali & Fletcher, 1971; Philips, 1969; Black & Osborne, 1965; Fox & Weiss, 1965; Guern *et al* 1968, Friedrich *et al*, 1970; Woolley & Wareing, 1972, a, b&c and Devlin & Witham, 1983).**

7) For break apical dominance in ***Dieffenbachia***, to increase branching, **Wilson and Nell (1983)** recommended BA at 500, 1000 or 2000 PPm., while **Henny (1986)** ecommended BA at 250 mg/L. However, **Imamura and Higaki (1988)** showed that ateral branch formation in ***Anthurium andreanum*** increased with increasing GA_3 from 0 o 500 PPm, or BA from 0 to 100 PPm, but the highest value was got by GA_3 at 500 PPm.

II. Improving The Vegetative Propagation of Scindapsus aureus And Philodendron scandens.

The aim of this part of work is mainly to improve the vegetative propagation of *Scindapsus aureus* and *Philodendron scandens* by using single node leafy soft stem cuttings. Accordingly, it was suggested that many experimental studies must by carried out to get sum clue informatien about the factors leading to the highest rooting ability and the success of the cuttings. The probable mode of such factor(s) actions(s) was also investigated under these study conditions. Series of preliminary and detail experimental studies were carried during the successive seasons extended from 1989 till 1991.

II. A. Preliminary Experiments

Experiment III A. a. (1989)

***Effect of various Hewitt's nutrient medium strength on rooting ability of Scindapsus aureus* and *Philodendron scandens* during water culture incubation.**

As mentioned before, the following Hewitt's nutrient solution strengths were used: 0/0 (distilled water), 1/8, 1/4, 1/2, 3/4 and 1/1. The cuttings of every species were incubated for 42 days from 16 May till 27 June of 1989. The percentage of rooted cuttings was recorded every week (7 days). The periodic increase percentage (P.I.P) was also calculated. These data are tabulated in Table (11 a & b).

From the available data, the following conclusions may be stated; on statistical basis:

(a) The highest percentage of rooted cuttings was gained by subjecting the cuttings of both species under 1/4 Hewitt's nutrient solution strength. In addition, 1/4 Hewitt's solution strength seemed to enhance early rooted cuttings formation. Accordingly, it was suggested that the best strength of Hewitt's solution is 1/4 strength followed by 1/2, 1/8, 3/4, 1/1 and 0/0 which ranked the sixth in this respect in the case of *Scindapsus aureus* cuttings. The same conclusion was also shown in the case of *Philodendron scandens*, with some exceptions as there is no differences between 1/8 and 3/4 strength and between 0/0 or 1/1.

The above mentioned results may be discussed on the basis that the osmotic potential of the used solution may take a role on rooting ability of both tested plant species

Table (11,a,b): Percentage of rooted cuttings and periodic increase percentage (P.I.P.)as affected by different Hewitt's solution strength of (a)*Scindapsus aureus* and *Philodendron scandens* during different periods of incubation.

(a)

Hewitt's solution strength	Parameter	Days of incubation						Mean
		7	14	21	28	35	42	
0/0	%	0.0	0.0	13.3	20.0	30.0	30.0	15.6
	P.I.P.		0.0	13.3	6.7	10.0	0.0	
1/8	%	0.0	13.3	23.3	33.30	40.0	40.0	25.0
	P.I.P.		13.3	10.0	10.0	6.7	0.0	
1/4	%	10.0	23.3	33.3	50.0	60.0	60.0	39.4
	P.I.P.		13.3	10.0	16.7	10.0	0.0	
1/2	%	10.0	16.7	30.0	33.3	40.0	40.0	28.3
	P.I.P.		6.7	13.3	3.3	6.7	0.0	
3/4	%	0.0	10.0	20.0	30.0	33.3	33.3	21.1
	P.I.P.		10.0	10.0	10.0	13.3	0.0	
1/1	%	0.0	0.0	16.7	23.3	30	30	16.7
	P.I.P.		0.0	16.7	6.6	6.7	0.0	
Mean		3.3	10.6	22.8	31.7	38.9	38.9	

L.S.D 5% between:Treatments (T)=1.1;Periods(P)=1.2 and T*P=2.0

(b)

0/0	%	0.0	0.0	10.0	20.0	30.0	30.0	15.0
	P.I.P.		0.0	10.0	10.0	10.0	0.0	
1/8	%	0.0	0.0	10.0	20.0	33.3	33.3	16.1
	P.I.P.		0.0	10.0	10.0	13.3	0.0	
1/4	%	0.0	13.3	23.3	40.0	50.0	50.0	29.4
	P.I.P.		13.3	10.0	16.7	10.0	0.0	
1/2	%	0.0	0.0	20.0	30.0	40.0	40.0	21.7
	P.I.P.		0.0	20.0	10.0	10.0	0.0	
3/4	%	0.0	0.0	10.0	20.0	33.3	33.3	16.1
	P.I.P.		0.0	10.0	10.0	13.3	0.0	
1/1	%	0.0	0.0	10.0	20.0	30.0	30.0	15.0
	P.I.P.		0.0	10.0	10.0	10.0	0.0	
Mean		0.0	2.2	13.9	25.0	36.1	36.1	

L.S.D 5% between:Treatments (T)=1.3;Periods(P)=1.4, and T.*P=2.1
P.I.P.=Periodic increas percentage.

side. On the other side the sufficient of one or more of nutrient elements may affect the rooting ability of the cuttings, as the least percentage of rooted cuttings was gained under distilled water in both species. In addition, there is no doubt that root initiation and its development depend on the reserve and the supplement of different nutrients ned for building out root tissues. The presense of such nutrient in cuttings or in the media in balance condition seems to play an important role in the induction of root initiation and its development.

There is no doubt that all of the essential nutrient elements seem to play a role on root initiation. The lack of one or more of such elements affected either root initiation or its development. However, very little is known about the solitary nutrient element on root initiation or its development except the role of boron. Many workers concluded that the presence of boron in the media of cuttings increased adventitious root on cuttings. They stated also that boron role in root initiation and development may be directly or indirectly through the change in metabolic processes leading to root initiation **(Hemberg, 1953; Gauch & Dugger, 1953 & 1954; Sisler *et al*, 1956; Humphries, 1960 and Fadl *et al*, 1986).**

It was suggested by **Fadl *et al* (1986)** that the effect of boron in adventitious root production of Le Cont Pear cuttings is in its role in the regulation of cell division and/or interaction with auxin to cause root initiation in the bases of cuttings.

b) It was concluded that most of rooted cuttings was gained from 14 till 35 days of incubation under the conditions of this experiment, as no root initiation was gained during the last period of incubation, i.e from 35 till 42 days.

Experiment III. A.b.

Seasonal changes in rooting ability of Scindapsus aureus and Philodendron scandens as related to the collection time of the year.

As mentioned before the cuttings of ***Scindapsus aureus and Philodendron scandens*** were collected monthly from August, 1989 till, July, 1990. Every collected cuttings were incubated for 42 days under 1/4 strength of Hewitt's nutrient solution as

ecommended from the last experiment. The percentage of rooted cuttings was also ncluded. These data are tabulated in table (12, a & b).

t may be concluded from such available data the following conclusions on statistical basis:

a) The highest rooted cuttings percentage was gained by the cuttings collected from une till August, while the least percentage was gained by collecting cuttings during December till February. In addition, intermediate percentage of rooted cuttings was gained by other collecting times. However, it may be recommended to collect the cuttings during all of the year except during December till Febraury.

These results may be discussed on the basis that external environmental factors especially atmosphiric temperature seemed to have a role on the metabolic processes either on mother plants or the isolated cuttings itself, as the cold season of the year (December till Febraury) the least amount of rooted cuttings was gained in such sub - tropic plant species. This result was true in both tested species. The time of the year in which the cuttings are taken is considered as one of the more important factors affecting rooting ability of many plant species, and that was detected from the bulk of literature of many workers among them, **(Childers & Snyder, 1957; El-Hakim *et al*, 1962; Baker & Link, 1963; Lanphear & Meahl, 1963; Hartmann & Kester, 1977; Shirzad & Miler, 1977; Tognoni *et al*, 1977; Fadl *et al*, 1986 and many others).**

This finding could be discussed on the basis that external and internal factor are responsible for the control of rooting ability of ***Scindapsus aureus*** and ***Philodendron scandens***, as the external prevailing environmental factors affecting the internal one.

Most of rooted cuttings percentage was gained from 14 till 35 days under incubation in 1/4 Hewitt's nutrient solution. In addition, collecting cuttings during June till August stimulated early root initiation on the cuttings, while other collection time seemed to alter the root formation on the cuttings.

Table (12,a): Seasonal changes in rooted cuttings percentage as affected by the time of the year of collecting cuttings of *Scindapsus aureus*

(a)

Monthes	Parameter	Days of incubation						Mean
		7	14	21	28	35	42	
August	%	0.0	23.3	33.3	53.3	60.0	60.0	38.3
	P.I.P.		23.3	10.0	20.0	6.7	0.0	
Sept.	%	0.0	23.3	30.0	53.3	60.0	60.0	37.8
	P.I.P.		23.3	6.7	23.3	6.7	0.0	
Octo.	%	0.0	20.0	30.0	33.3	53.3	53.3	31.7
	P.I.P.		20.0	10.0	3.3	20.0	0.0	
Nov.	%	0.0	0.0	20.0	33.3	50.0	50.0	25.6
	P.I.P.		0.0	20.0	13.3	16.7	0.0	
Des.	%	0.0	0.0	0.0	23.3	30.0	30.0	13.9
	P.I.P.		0.0	0.0	23.3	6.7	0.0	
Jan.	%	0.0	0.0	0.0	20.0	30.0	30.0	13.3
	P.I.P.		0.0	0.0	20.0	10.0	0.0	
Feb.	%	0.0	0.0	0.0	20.0	33.3	33.3	14.4
	P.I.P.		0.0	0.0	20.0	13.3	0.0	
March	%	0.0	13.3	30.0	40.0	50.0	50.0	30.6
	P.I.P.		13.3				0.0	
April	%	0.0	20.0	30.0	40.0	56.7	56.7	33.9
	P.I.P.		20.0	16.7	10.0	16.7	0.0	
May	%	0.0	20.0	30.0	40.0	60.0	60.0	35.0
	P.I.P.		20.0	10.0	10.0	20.0	0.0	
June	%	0.0	23.3	33.3	53.3	60.0	60.0	38.3
	P.I.P.		23.3	10.0	20.0	6.7	0.0	
July	%	0.0	23.3	33.3	53.3	60.0	60.0	38.3
	P.I.P.		23.3	10.0	20.0	6.7	0.0	
Mean		0 .0	13.9	22.5	38.6	50.3	50.3	

L.S.D. 5%=between: Days of incubation(D)=0.4
Time ofthe year (T)=0.2
D*T.=0.6

Table (12,b): Seasonal changes in rooted cuttings percentage as affected by the time of the year of collecting cuttings of *Philodendron scandens*

(b)

Monthes	Param-eter	Days of incubation						Mean
		7	14	21	28	35	42	
August	%	0.0	16.7	33.3	46.7	56.7	56.7	35.0
	P.I.P.		16.7	16.6	13.4	10.0	0.0	
Sept.	%	0.0	16.7	33.3	46.7	56.7	56.7	35.0
	P.I.P.		16.7	16.6	13.4	10.0	0.0	
Octo.	%	0.0	10.0	30.0	40.0	53.3	53.3	31.1
	P.I.P.		10.0	20.0	10.0	13.3	0.0	
Nov.	%	0.0	10.0	20.0	33.3	40.0	40.0	23.9
	P.I.P.		10.0	10.0	13.3	6.7	0.0	
Dec.	%	0.0	0.0	0.0	10.0	23.3	23.3	9.4
	P.I.P.		0.0	0.0	10.0	13.3	0.0	
Jan.	%	0.0	0.0	0.0	10.0	20.0	20.0	8.3
	P.I.P.		0.0	0.0	20.0	10.0	0.0	
Feb.	%	0.0	0.0	0.0	13.3	30.0	30.0	12.2
	P.I.P.		0.0	0.0	13.3	16.7	0.0	
March	%	0.0	10.0	23.3	30.0	43.3	43.3	25.0
	P.I.P.		10.0	13.3	6.7	13.3	0.0	
April	%	0.0	13.3	30.0	40.0	50.0	50.0	30.6
	P.I.P.		13.3	16.7	10.0	10.0	0.0	
May	%	0.0	13.3	30.0	40.0	53.3	53.3	31.7
	P.I.P.		13.3	16.7	10.0	13.3	0.0	
June	%	0.0	16.7	33.3	43.3	53.3	53.3	33.3
	P.I.P.		16.7	16.6	10.0	10.0	0.0	
July	%	0.0	16.7	33.3	46.7	53.3	53.3	33.9
	P.I.P.		16.7	16.6	13.4	6.6	0.0	
Mean		0.0	10.3	22.2	33.3	44.4	44.4	

L.S.D.at 5%=between:Days of incubation(D)=0.6
Time of the year (T)=0.4
D*T.=0.9

xperiment III A.c (1990)

ooting ability of Scindapsus aureus and Philodendron scandens cuttings as related to ıe node position on stem.

To answer the question about the effect of node position, i.e. node age on rooting bility of soft single node leafy stem cuttings, eight node positions from the first youngest ərminal till 8th. oldest basal ones were separated, and subjected for 42 days under 1/4 lewitt's nutrient solution as recommended from the first experiment of both tested species. hirty cuttings of every position was arranged in three replicates (ten cuttings of every eplicate). Percentage of rooted cuttings was recorded weekly, and the periodic increase ıercentage (P.I.P.) was calculated. These data are tabulated in Table (13, a & b) for *Scindapsus aureus* and *Philodendron scandens* respectively.

It was concluded from the data that no significant effect of node position, i.e. node nd leaf age, on the percentage of rooted cuttings of both tested species. In addition, it ould be concluded that the grand period of root initiation was got from 14 till 28 days. Accordingly, one could be concluded that the age of cuttings seemed to have neither role on ooting ability, nor on the speed of root initiation as the highest wave of rooted cuttings ɔccurred during the period extended from 14 till 28 days of all cuttings of various positions ınder the conditions of this experiment.

Experiment III A.d.

Effect of some growth regulators on rooting ability of Scindapsus aureus and Philodendron scandens (1990).

It was shown from the previous treatments that the strength of the nutrient solution and the time of the year during which the cuttings were collected affected the rooting ability of ***Scindapsus aureus*** and ***Philodendron scandens*** cuttings. However, the percentage of rooted cuttings resulted from the best treatment was still low. It was shown from the bulk of literature dealing with rooting ability that many of growth regulators with auxin type, i.e. IBA or NAA seemed to enhance the rapid development of adventitious roots and buds in many cuttings of different plant species. Accordingly, our study was extended to include the

Table(13,a): Percentage of rooted cuttings and its periodic increase percentage (P.I.P) of one node soft leafy stem cuttings of *Scindapsus aureus* as affected by node position on the stem (from terminal first one to the 8th basel one).

(a)

Node Position	Param-eter	Days of incubation						Mean
		7	14	21	28	35	42	
1	%	0.0	7.7	16.7	53.3	56.7	56.7	31.9
	P.I.P.	7.7	9.0	36.6	3.4	0.0		
2	%	0.0	7.7	16.7	53.3	56.7	56.7	31.9
	P.I.P.	7.7	9.0	36.6	3.4	0.0		
3	%	0.0	7.7	16.7	53.3	56.7	56.7	31.9
	P.I.P.	7.7	9.0	36.6	3.4	0.0		
4	%	0.0	7.7	20.0	56.7	60.0	60.0	34.1
	P.I.P.	7.7	12.3	36.7	3.3	0.0		
5	%	0.0	10.0	20.0	56.7	60.0	60.0	34.5
	P.I.P.	10.0	10.0	36.7	3.3	0.0		
6	%	0.0	10.0	20.0	53.3	56.7	56.7	32.8
	P.I.P.	10.0	10.0	36.7	3.4	0.0		
7	%	0.0	7.7	20.0	53.3	56.7	56.7	32.4
	P.I.P.	7.7	12.3	36.7	3.4	0.0		
8	%	0.0	7.7	20.0	53.3	60.0	60.0	33.5
	P.I.P.	7.7	12.3	36.7	6.7	0.0		
Mean		0.0	8.3	18.8	54.2	57.9	57.9	

L.S.D.at 5%=between :Node position (N)=N.S.
: Periods(P) =N.S.
: N*P =N.S.

Table(13,b): Percentage of rooted cuttings and its periodic increase percentage (P.I.P) of one node soft leafy stem cuttings of ***Philodendron scandens*** as affected by node position on the stem (from terminal first to the 8th basel ones).

(b)

Node position	Parameter	Days of incubation						Mean
		7	14	21	28	35	42	
1	%	0.0	0.0	6.7	26.7	46.7	46.7	21.1
	P.I.P.		0.0	6.7	20.0	20.0	0.0	
2	%	0.0	3.3	6.7	26.7	46.7	46.7	21.7
	P.I.P.		3.3	3.4	20.0	20.0	0.0	
3	%	0.0	3.3	6.7	30.0	50.0	50.0	23.3
	P.I.P.		3.3	3.4	23.3	20.0	0.0	
4	%	0.0	3.3	10.0	30.0	50.0	50.0	23.9
	P.I.P.		3.3	6.7	20.0	20.0	0.0	
5	%	0.0	0.0	10.0	30.0	53.3	53.3	24.4
	P.I.P.		0.0	10.0	20.0	23.3	0.0	
6	%	0.0	3.3	10.0	26.7	46.7	46.7	22.2
	P.I.P.		3.3	6.7	16.7	20.0	0.0	
7	%	0.0	0.0	6.7	26.7	46.7	46.7	21.1
	P.I.P.		0.0	6.7	20.0	20.0	0.0	
8	%	0.0	0.0	10.0	30.0	50.0	50.0	23.3
	P.I.P.		0.0	10.0	20.0	20.0	0.0	
Mean		0.0	1.7	8.4	28.4	48.8	48.8	

L.S.D.at 5%=between :Node position (N)=N.S.
: Periods(P) =N.S.
: N*P =N.S.

fect of IBA or NAA with 0.0, 5, 10 or 20 ppm. and the mixture of both growth regulators :1) from each. The treated cuttings, as mentioned before in material and methods were cubated for 42 days under 1/4 Hewitt's nutrient solution. The following data were :corded: (a) percentage of rooted cuttings during different periods of growth. As many eatments affected the root shape and seemed to have some abnormalities on the root ystem development and the percentage of abnormal rooted cuttings after 42 days of ıcubatien was also recorded. In addition, number of adventitious roots and the length of ɔot system were also included. These data are tabulated in tables (14,15,16 and 17). The bnormal root shape was also recorded in Photos. (29, 30 , 31, 32 & 34).

Effect of IBA, NAA or their combinations on rooting ability of Scindapsus aureus and Philodendron scandens. (Tables 14 & 15).

t could be concluded from such data the following conclusions :

a) IBA, NAA or their combinations stimulate the rooting ability of ***Scindapsus aureus*** and ***Philodendron scandens***. However, IBA seemed to be superior in this respect followed by BA + NAA while NAA ranked the third in this respect.

b) Rooting ability of ***Scindapsus aureus*** and ***Philodendron scandens*** decreased with ıncreaseing the rates of IBA, NAA or IBA + NAA, as the lowest rooted cuttings percentage was gained by using the highest rates of such growth regulators.

c) The highest rooted cuttings percentage was gained by using IBA at the rate of 5 PPm.

d) In spite of the stimulatory effect of the tested growth regulators on rooting ability of both species, many of the resulted cuttings seemed to have abnormal shape of root system (see photos. 29, 30, 31, 32, 33 and 34).

e) The percentage of cuttings having abnormal root shape increased with increasing the growth regulators rates. The least effect was gained by using IBA at the rate of 5 ppm (Tables 16 & 17).

f) IBA, NAA or their combinations affected the number of adventitious roots per one cutting and the length of the formed root system of the rooted cuttings after 42 days of incubation under 1/4 Hewitt's nutrient solution conditions. Some treatments seemed to have a stimulatory effect on adventitious root number, while other seemed to have no effect

Table(14): Percentage of rooted cuttings of *Scidapsus aureus* during different periods of incubation under water culture conditions

substance	PPm	Parameter	Days of incubation						Mean
			7	14	21	28	35	42	
Control	0.0	%	0.0	14.3	33.3	47.6	52.4	52.4	33.3
		P.I.P.		14.3	19.0	14.3	4.8	0.0	
IBA	5	%	14.3	38.1	66.7	76.2	81	81	59.6
		P.I.P.		23.8	28.6	9.5	4.8	0.0	
	10	%	9.5	33.3	52.4	66.7	71.4	71.4	50.8
		P.I.P.		23.8	14.1	14.3	4.7	0.0	
	20	%	0.0	14.0	42.9	57.1	66.7	66.7	42.1
		P.I.P.		19.0	23.9	14.2	9.1	0.0	
Mean		%	7.9	30.1	54	66.7	73	73	50.8
		P.I.P		22.2	23.9	14.2	9.1	0.0	
NAA	5	%	4.8	19.0	38.1	57.1	61.9	61.9	40.5
		P.I.P.		14.2	19.1	19.0	4.8	0.0	
	10	%	0.0	14.3	28.6	47.6	57.1	57.1	34.1
		P.I.P.		14.3	14.3	19.0	9.5	0.0	
	20	%	0.0	9.5	23.8	42.9	52.4	52.4	30.2
		P.I.P.		9.5	14.3	19.1	9.5	0.0	
Mean		%	1.6	14.3	30.2	49.2	57.1	57.1	34.9
		P.I.P		12.7	15.9	19.0	7.9	0.0	
IBA + NAA	2.5+2.5	%	9.5	28.6	42.9	52.4	61.9	61.9	42.9
		P.I.P.		19.1	14.3	9.5	9.5	0.0	
	5+5	%	0.0	19.0	33.3	47.6	57.1	57.1	35.7
		P.I.P.		19.0	14.3	14.3	9.5	0.0	
	10+10	%	0.0	19.0	28.6	42.9	52.4	52.4	32.6
		P.I.P.		19.0	9.6	14.3	9.5	0.0	
Mean		%	3.2	22.2	34.9	47.6	57.1	57.1	37
		P.I.P		19.0	12.7	12.7	9.5	0.0	
Total mean		%	4.2	22.2	39.7	54.5	62.4	62.4	
				18.0	17.0	14.8	7.9	0.0	

L.S.D:5%:Substance(S) = 0.3
Concentration (C) = 0.2
Periods(P) = 0.3
S*C = 0.6
S*C*P = 0.8
C*P = 0.6
S*P = 0.6

ıble(15): Percentage of rooted cuttings of *Philodendron scandens* during different periods of incubation under water culture conditions.

ıbstance	ppm	param-eter	Days of incubation						mean
			7	14	21	28	35	42	
	0/0	% P.I.P.	0.0	0.0	14.3	33.3	47.6	47.6	23.8
			0.0	14.3	19.0	14.3	0.0		
IBA	5	% P.I.P.	4.8	9.5	33.3	42.9	71.4	71.4	38.9
			4.7	23.8	9.6	28.5	0.0		
	10	% P.I.P.	0.0	4.8	23.8	42.9	66.7	66.7	34.2
			4.8	19.0	19.1	23.8	0.0		
	20	% P.I.P.	0.0	4.8	19.0	38.1	52.4	52.4	27.8
			4.8	14.2	19.1	14.3	0.0		
Mean		% P.I.P	1.6	6.4	25.4	41.3	63.5	63.5	33.6
			4.8	19.0	15.9	22.2	0.0		
NAA	5	% P.I.P.	0.0	9.5	19.0	33.3	47.6	47.6	26.2
			9.5	9.5	14.3	14.3	0.0		
		% P.I.P.	0.0	4.8	19.0	33.3	47.6	47.6	25.4
			4.8	14.2	14.3	14.3	0.0		
		% P.I.P.	0.0	4.8	19.0	28.6	38.1	38.1	21.4
			4.8	14.2	9.6	9.5	0.0		
Mean		% P.I.P	0.0	6.4	19.0	31.7	44.4	44.4	24.3
			6.4	12.6	12.7	12.7	0.0		
IBA NAA	2.5+ 2.5	% P.I.P.	4.8	9.5	23.8	38.1	57.1	57.1	31.7
			4.7	14.3	14.3	19.0	0.0		
	5+5	% P.I.P.	0.0	4.8	23.8	38.1	52.2	52.2	28.5
			4.8	19	14.3	14.1	0.0		
	10+10	% P.I.P.	0.0	4.8	19	28.6	47.6	47.6	24.6
			4.8	14.2	9.5	19	0.0		
Mean		% P.I.P	1.6	6.4	22.2	34.9	52.3	52.3	28.3
			4.8	15.8	12.7	17.4	0.0		
Total Mean		% P.I.P	1.1	6.4	22.2	36	53.4	53.4	
			5.8	15.8	13.8	17.4	0.0		

.D:5%:substance(s)=0.1 concentration(c)=0.1,Periods(P)=0.2 S*C=0.3
=0.3,C*P=0.3, S*C*P=0.6

Table(16): Effect of IBA, NAA or IBA + NAA at various rates on deformed% of rooted cuttings as related to rooted cuttings, root number per cutting and root system length per cutting of *Scindapsus aureus* after 42 days of incubation.

substance	PPm	% ofde-formed cutting	No. of roots	root system length
Control	0/0	0	1.0	8.2
IBA	5	82.4	6.5	5.9
	10	93.3	1	4.3
	20	100	1	0.7
Mean		91.9	2.8	3.6
NAA	5	92.3	3.3	3.5
	10	100	3.3	2
	20	100	1	0.4
Mean		97.4	2.5	2
IBA + NAA	2.5+2.5	92.3	3.2	3.9
	5+5	100	2.1	2.9
	10+10	100	1.1	0.5
Mean		97.4	2.1	2.4
L.S.D 5%		1.1	0.4	0.9

Table(17): Effect of IBA, NAA or IBA + NAA at various rates on deformed% rooted cuttings as related to the rooted cuttings, root number / cutting and root system length / cutting of *Philodendron scandens* after 42 days.

substance	PPm	% of deformed cutting	No of roots	Root system length
Control	0/0	0	2.1	1.0
IBA	5	80	7.3	10.3
	10	85.7	15.5	8.2
	20	100	10.2	3.2
Mean		88.6	11	7.2
	5	90	10.3	4.1
	10	100	13.4	2.6
	20	100	17.7	1.0
Mean		96.7	13.8	2.6
NAA	2.5+2.5	83.3	8.2	5.1
	5+5	100	7.1	2.3
	10+10	100	6.1	1.0
Mean		94.4	7.1	2.8

L.S.D 5% 1.2 0.5 1.0

related to the rooted cuttings. However, all of IBA, NAA or IBA + NAA treated cutting ive short root system as compared with control cuttings. The least effect was gained by ing 5 ppm IBA.

The above mentioned results could be discussed on the fact that auxin type growth gulators stimulates the number of root initiation but retars the root elongation **(Devlin nd Witham, 1983 and many other workers).**

I.B. Detail Experimental Studies

xperiment III B.a.

ombined effect of IBA and BA on the success of Scindapsus aureus cuttings.

It was concluded from the previous experiment that the use of IBA at 5, 10, & 20 pm (or NAA) seemed to have unfavourable effect on root shape in spite of their enhancing ffect on rooting ability. Accordingly, it was thought advisable to test the very low oncentration of IBA in the presence of BA. The used rates of IBA were 0.0, 0.1 or 0.2 pm; while such rates of BA were 0.0 ,5 or 10 ppm (in combinations). The data were ollected during water culture incubation for 35 days (the maximum yield of rooted uttings), and during pot periods which extended into another 21 weeks, i.e. 147 days (the tage of marketable phase).

a) Combined effect of IBA and BA on the percentage of rooted cuttings of Scindapsus aureus during water culture incubation. (Table, 18).

It must be mentioned that under the new very low IBA cencentration the abnormal deformed roots were completely absent (see the photos 35 & 36). The following conclusions could be summarized as follows :

i) At the end of water culture periods, i.e. after 35 days, IBA at 0.1 ppm stimulated greatly the rooted cuttings percentage. However, IBA at 0.2 ppm. enhanced such percentage, but that was less than 0.1 ppm. BA. stimulated such percentage and that was higher at 10 ppm. These facts on the bases when it was compared the data as related to those received 0.0 ppm of both tested substances.

Table (18): Percentage of rooted cuttings during the water culture incubation as affected by the combined treatments with IBA and BA.

IBA P P m	BA P P m	Days of incubation					Mean
		7	14	21	28	35	
0.0	0.0	20·0	40·0	46.7	60	65	46.3
	5	90·0	96.7	100	100	100	97.3
	10	80·0	83.3	96.7	100	100	92·0
Mean		63.3	73.3	81.1	86.7	88.3	78.5
0.1	0.0	23.3	36.7	56.7	80	83.3	56
	5	36.7	73.3	73.3	86.7	93.3	72.7
	10	73.3	83.3	90·o	93.3	96.7	87.3
Mean		44:4	64.4	73.3	86.7	91.1	72·0
0.2	0.0	20	50·0	53.3	66.7	73.3	52.7
	5	20	43.3	53.3	70·o	83.3	54
	10	20	50·0	53.3	70·0	90	56.7
Mean		20	47.8	53.3	68.9	82.2	54.5
Total Mean		42.6	61.8	69.2	80.8	87.2	

Mean of BA

BA	0.0	21.1	42.2	52.2	68.9	73.9	50.7
	5	48.9	71.1	75.5	85.6	92.2	74.7
	10	57.8	72.2	80	87.8	95.6	78.8
Mean		42.6	61.8	69.2	80.8	87.2	68.3

L.S.D at 5% between IBA(I)=3.3,BA(B)=3.3,Period(P)=4.4,
I*B=5.1 I*P=6.1 B*P=6.1,I*B*P=7.9

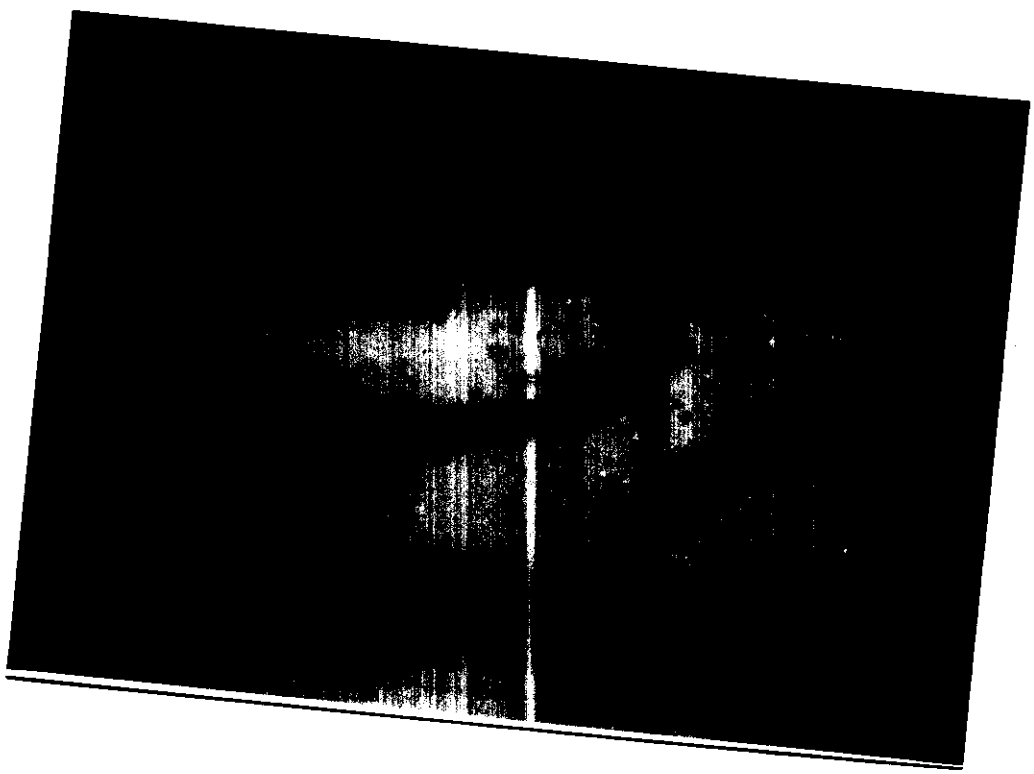


Photo. 29 (* 1.0):

Abnormal developed adventitious root of ***Scindapsus aureus*** after 42 days of incubation under 1/4 Hewitt's nutrient solution and treated with 10 ppm of IBA. See the swelling tumourized abnormal root cap.

Photo. 30 (* 0.25):

Rooted NAA treated cuttings of ***Scindapsus aureus*** (1 & 5) treated with 5 ppm; (6): treated with 20 ppm; (7): treated with 10 ppm. after 42 days of incubation under 1/4 Hewitt's nutirent solution. See the abnormal shape of roots by using different NAA rates. The root length decreased with increasing NAA level .

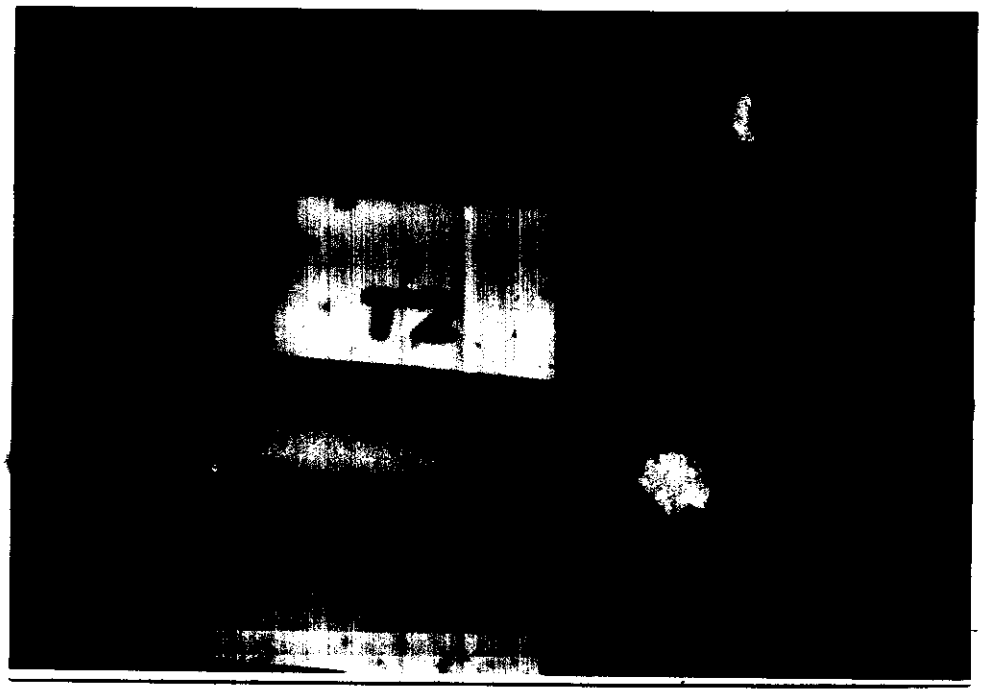


Photo. (31) (* 0.5):

20 ppm IBA treated cutting of ***Scindapsus aureus*** showing the very short abnormal root shape with terminal swelling root cap after 42 days from incubation under 1/4 Hewitt's nutrient solution.

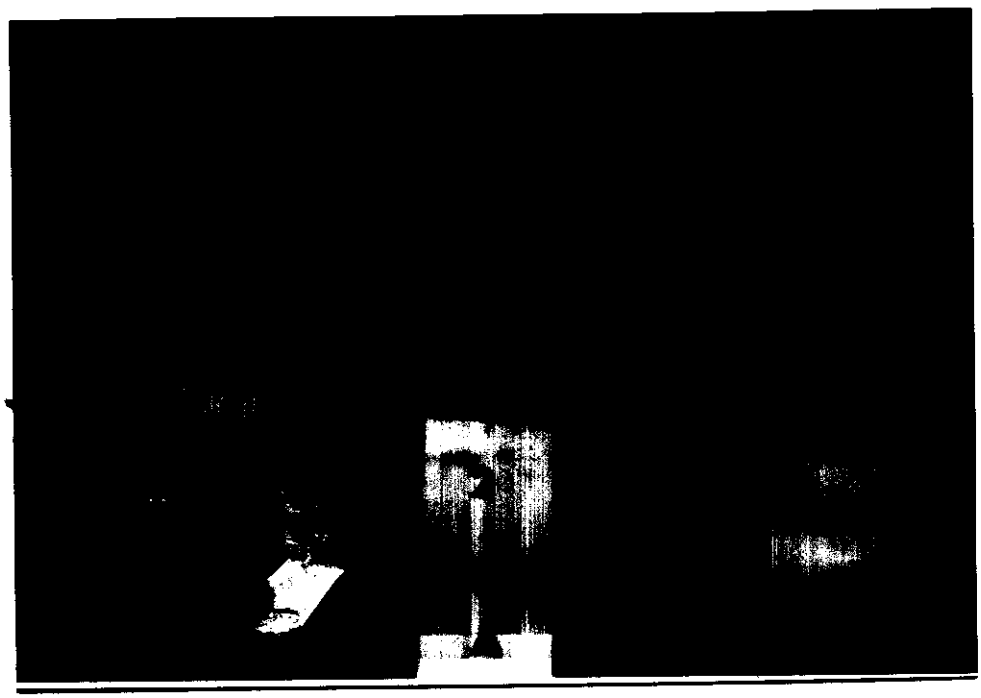


Photo. (32) (* 0.25):

Rooted IBA treated cuttings of ***Philodendron scandens*** after 28 days of incubation under 1/4 Hewirtt's nutrient solution, (1) treated with 0.0 ppm., (having one normal developed adventitious root), (2) treated with 5 ppm., (having numerous adventitious roots with secondary branches, (10) treated with 10 ppm, (having numerous short adventitious roots i.e. abnormal root system).

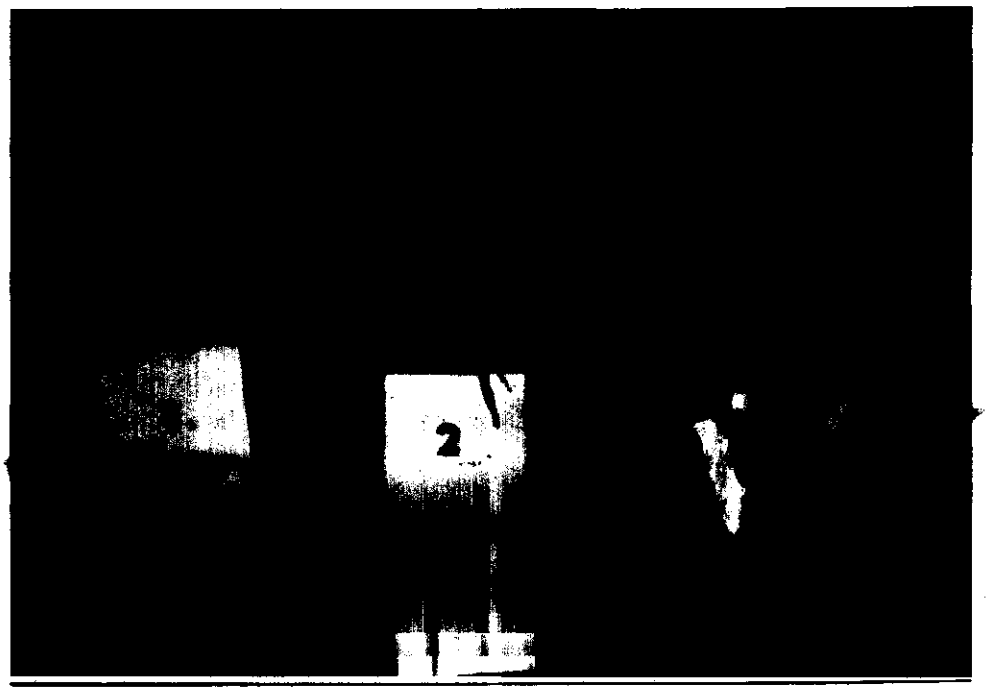


Photo. (33) (* 0.25):

Rooted cuttings. of ***Philodendron scandens*** treated with IBA after 42 days of incubation under 1/4 Hewitt's nutrient solution; (1) treated with 0.0 ppm., (having normal roots); (2) treated with 5 ppm, (having numerous adventitious root system with heavy secondary root branches); (3) treated with 10 ppm, (showing the abnormal heavy and very stunted roots (at the right side of the Photo.).

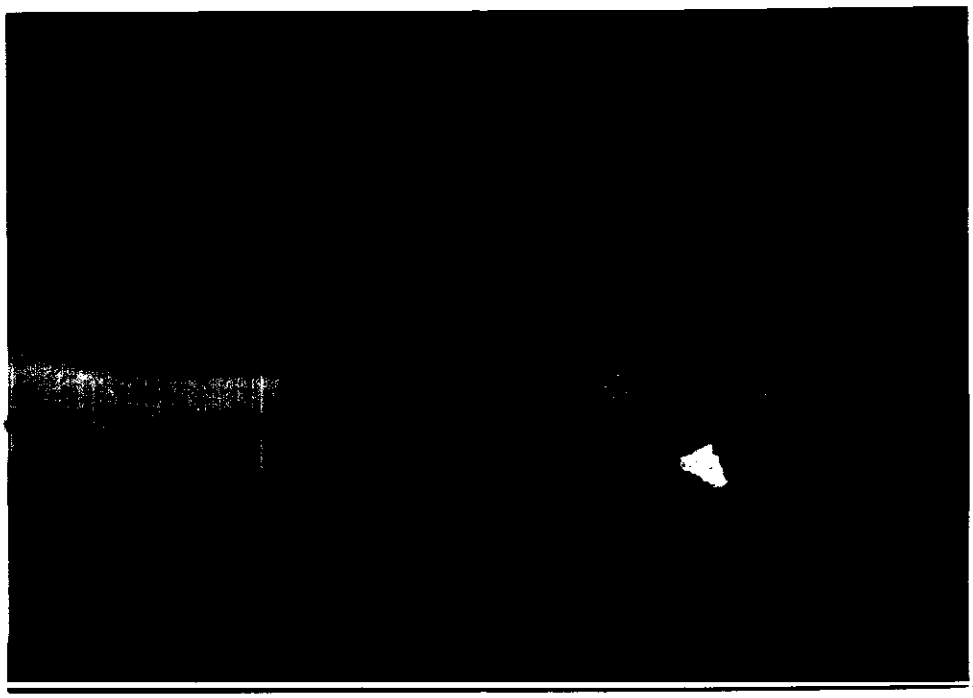


Photo. (34):

Rooted cuttings of ***Philodendron scandens*** treated with 20 ppm IBA. See the abnormal and deformed very short numerous adventitious root system. It must be mentioned that many rooted cuttings treated with either 5 or 10 ppm IBA showed the some abnormal root shape. Also NAA treated cuttings showed the same observation.

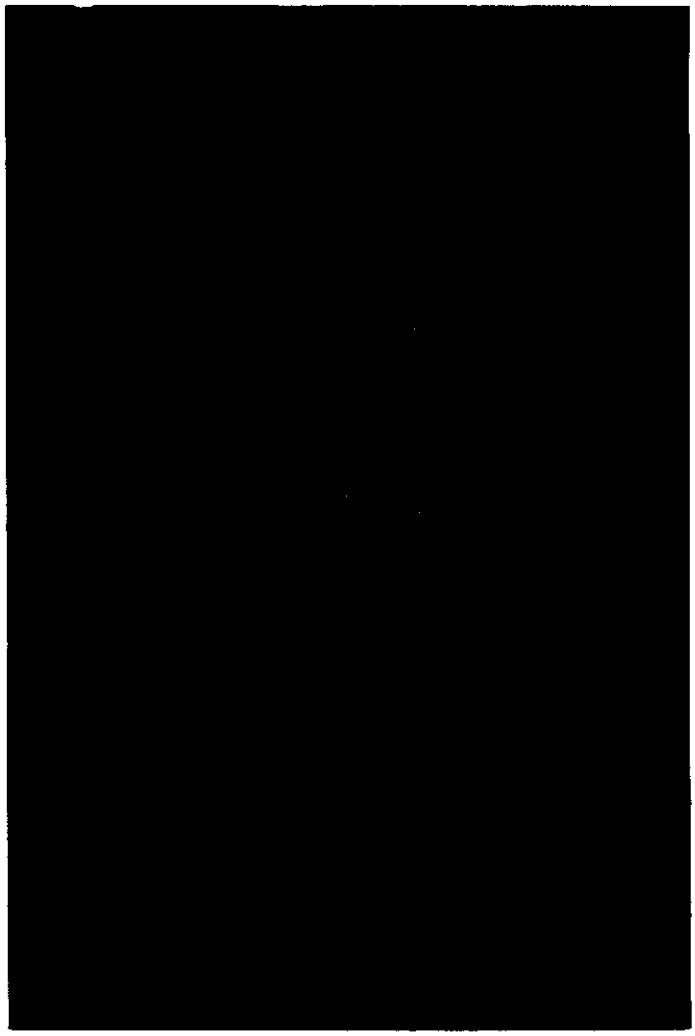


Photo. 35 (* 3.0):

Rooted and shooted cutting of ***Scindapsus aureus***, treated with 0.2 ppm. IBA after seven days of incubation under water culture conditions of 1/4 Hewitt's nutrient solution. See the early normal developing adventitious root and bud.

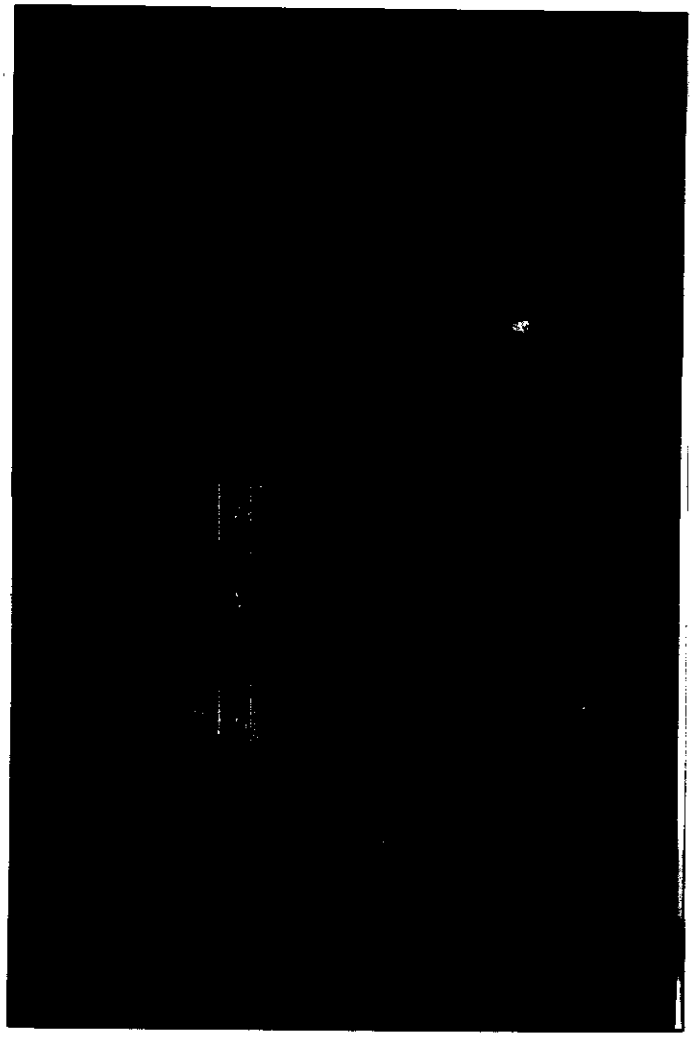


Photo. 36 (* 2.0):

Developing root of ***Scindepsus aureus*** on cutting treated with 0.2 ppm IBA after 21 days of incubation under water culture conditions of 1/4 Hewitt's nutrient solution. See the formations of two hairy secondary roots and the secondary root initiation area which appears as white spot area at the terminal root portion. It must be mentioned that 0.2 ppm. IBA stimulated early formation of secondary root initiation and formation, without any abnormal shape.

ii) Early high rooted cuttings were obtained by using BA, as 100% of rooted ıttings were gained after 21 days of incubation in the absence of IBA. However, 10 ppm A alone delay the complete success of cuttings as 100% rooted cuttings were gained after 3 days of incubation.

iii) The above mentioned data indicate also that, inspite of the stimulatory effect of 3A on rooting ability of ***Scindapsus aureus*** such stimulatory effect increased by using BA eside IBA. These results indicate, in other words, that BA strengthed the stimulatory ffect of IBA on rooting ability.

b) Combined effect of IBA and BA on number of roots per one cuttings as elated to whole cuttings (either rooted or not rooted ones (Table, 19).

It was concluded from the available data the following conclusions :

i) Number of roots initiated per one cutting increased from 7 till 35 days under ıcubation in water culture of 1/4 Hewitt's nutrient solution, as a general.

ii) IBA and BA affected the number of root initiation. The best effect was gained by BA ıt the rate of 5 or 10 ppm.

iii) It must be mentioned again that there was no harmoful effect on root shape by using ıny growth regulator under the tested rates.

:) Percentage of fresh weight (per one cutting) as related to the first start sample during water culture incubation periods. (Table, 20) and the rate of such percentage increments (Table, 21)

The fresh weight of the different treated cuttings was estimated weekly (every 7 days from the start sample). Such weight was converted into percentage increase as related to the start sample, as the fresh weight was differed according to the leaf size. Again it was used single node leafy soft stem cutting during the course of this work. Accordingly, it was thought to compare the changes in fresh weight of different treatment as related to constant value, i.e. the percentage as related to the start sample (100%). The rate of interval or periodic increase percentage was also included (Table 21). It may be concluded from these data the following conclusions:

Table(19): Number of roots/cutting (rooted or non rooted ones) during water culture periods (1/4 Hewitt's nutrients) as affected by the combined treatments with IBA and BA.

IBA P P m	BA P P m	Days of incubation					Mean
		7	14	21	28	35	
0.0	0.0	0.4	1.1	2.1	1.3	1.4	1.1
	5	1.3	1.9	2.2	2.6	2.7	2.1
	10	1.3	1.6	2.1	2.6	2.8	2.1
Mean		1.0	1.5	1.8	2.2	2.3	1.8
0.1	0.0	0.4	0.7	0.9	1.4	2.0	1.1
	5	0.5	1.4	1.5	1.7	2.3	1.5
	10	1.1	1.2	1.2	1.3	1.8	1.3
Mean		0.7	1.1	1.2	1.5	2.0	1.3
0.2	0.0	0.4	0.5	0.7	1.3	1.8	0.9
	5	0.4	1.1	1.2	1.3	1.6	1.1
	10	0.4	1.1	1.2	1.3	1.9	1.2
Mean		0.4	0.9	1.0	1.3	1.8	1.1
Total Mean		0.4	1.2	1.3	1.7	2.0	1.4

Mean of BA

BA	0.0	0.7	1.2	1.3	1.7	2.0	1.4
	5	0.4	0.8	0.9	1.3	1.7	1.0
	10	0.7	1.5	1.6	1.9	2.2	1.6
Mean		0.7	1.2	1.3	1.6	2.2	1.4

L.S.D at 5% between IBA(I)=0.1 BA(B)=0.1 Period (P)=0.2
B*P=0.3 I*B*P=0.3
I*B=0.3 I*P=0.3

Table(20): Percentage of fresh weight as related to the first start sample during water culture incubation periods.

IBA PPm	BA PPm	start sample	Days of incubation					Mean
			7	14	21	28	35	
0.0	0.0	100	112.6	115.5	121.7	136.5	144.3	121.8
	5	100	109.6	114.1	116.7	121.0	129.2	115.1
	10	100	117.7	118.5	122.2	125.3	131.3	119.2
Mean		100	113.3	116.0	120.2	127.6	134.9	118.7
0.1	0.0	100	109.7	117.4	121.6	138.4	148.9	122.7
	5	100	106.3	112.2	114.2	122.2	132.8	114.6
	10	100	107.0	109.0	111.3	113.7	117.6	109.8
Mean		100	107.7	112.9	115.7	124.8	133.1	115.7
0.2	0.0	100	116.4	122.5	130.3	140.0	154.4	127.3
	5	100	112.4	114.6	115.8	119.9	129.2	115.3
	10	100	111.4	114.0	114.9	117.2	123.1	113.4
Mean		100	113.4	117.0	120.3	125.7	135.6	118.7
Total mean		100	111.5	115.3	118.7	126.0	134.5	117.7

			Mean of BA					
BA	0.0	100	112.9	118.5	124.5	138.3	149.2	123.9
	5	100	109.4	113.6	115.6	121.0	130.4	115.0
	10	100	112.0	113.8	116.1	118.7	124.0	114.1
Total mean		100	111.4	115.3	118.7	126.0	134.5	117.7

L.S.D at 5% between: IBA(I) = 0.3
BA (B) = 0.3
Period(p) = 0.5
I*B = 0.6
I*P = 0.6
B*P = 0.7
I*B*P = 1.7

Table(21): Rate of percentage increase of fresh weight as related to start sample during water culture incubation periods.

IBA PPm	BA PPm	start sample	Days of incubation					Total % increas	Mean
			7	14	21	28	35		
0.0	0.0	0.0	12.6	2.9	6.2	14.8	7.8	44.3	8.9
	5	0.0	9.6	4.5	2.6	4.3	8.2	29.2	5.8
	10	0.0	17.7	0.8	3.7	3.1	6.0	31.3	6.3
Mean		0.0	13.3	2.7	4.2	7.4	7.3	34.9	7.0
0.1	0.0	0.0	9.7	7.7	4.2	16.8	10.5	48.9	9.8
	5	0.0	6.3	5.9	2.0	8.0	10.6	32.8	6.6
	10	0.0	7.0	2.0	2.3	2.4	3.9	17.6	3.5
Mean		0.0	7.7	5.2	2.8	9.1	8.3	33.1	6.6
0.2	0.0	0.0	16.4	6.1	7.8	9.7	14.4	54.4	10.9
	5	0.0	12.4	2.2	1.2	4.1	9.3	29.2	5.8
	10	0.0	11.4	2.6	0.9	2.3	5.9	23.1	4.6
Mean		0.0	13.4	3.6	3.3	5.4	9.9	35.6	7.1
Total mean		0.0	11.5	3.8	3.4	7.3	8.5	34.4	6.9
	0.0	0.0	12.9	5.6	6.1	13.8	10.9	49.3	9.9
BA	5	0.0	9.4	4.2	1.9	5.5	9.4	30.4	6.1
	10	0.0	12.0	1.8	2.3	2.6	5.3	24.0	4.8
Total mean		0.0	11.4	3.9	3.4	7.3	8.5	34.6	6.9

L.S.D at 5% between: IBA(I) = 0.2
BA (B) = 0.2
period(P) = 0.3
I*B = 0.5
I*P = 0.5
B*P = 0.6
I*B*P = 1.3

i) The percentage of fresh weight increased progressively and continously from the start mple till the end of water culture incubatien penriods, i.e. till 35 days of all treated ttings.

ii) IBA seemed to have very little effect on percentage increase of fresh weight at the end water culture incubation period (35 days), as 0.0, 0.1 and 0.2 ppm. of IBA treated ittings showed 34.9, 33,1 and 35.6 total percentage increase respectively with mean values f 7, 6.6 and 7.1 percentage for every 7 days. However, very great and variable increase uring different periods of incubation was observed.

iii) As a general, BA declined the total percentage increase of fresh weight at the end of ıcubation, and such decline increased with increasing the the tested rate of BA from 0.0 till 0 ppm, with great variations during different periods of incubation without no clear trend.

iv) It may be concluded, as a general, that the grand period of fresh weight percentage vas gained during the first seven days and from 21 till 35 days. In this concentration, it nust be mentioned that fresh weight is the net gain of water absorption and/or the rate of ıssimilation activities which include salt and organic assimilation. Accordingly it may be :oncluded that different treatments seemed to have a role on water absorption rate and/or :he assimilation activities rates.

v) With regards to the combined effects of IBA and BA, it may be concluded that the depressive effect of BA on fresh weight increments was mostly increased by using IBA especially when IBA was used at 0.2 ppm. In addition, using IBA at the rate of 0.1 or 0.2 ppm. alone (with 0.0 ppm BA) increased greatly the fresh weight percentage at the end of water incubation period with superior effect at the rate of 0.2 ppm IBA.

d) Percentage of dry weight (per one cutting) as related to the first start sample during water culture incubation periods (Table, 22), and the rate of such percentage increments (Table, 23).

The available data may indicate the following conclusions:

i) The same trend was gained as the foregoing results in the case of proportion increments of fresh weight, with some exceptions. The higher proportion of dry weight increment at the end of water culture incubation which extended to 35 days was gained by

Table(22): Percentage of dry weight per one cutting as related to the first start sample during water culture incubation periods.

IBA P P m	BA P P m	Days of incubation					Mean
		7	14	21	28	35	
0.0	0.0	20	40	46.7	60	65	46.3
	5	90	96.7	100	100	100	97.3
	10	80	83.3	96.7	100	100	92
Mean		63.3	73.3	81.1	86.7	88.3	78.5
0.1	0.0	23.3	36.7	56.7	80	83.3	56
	5	36.7	73.3	73.3	86.7	93.3	72.7
	10	73.3	83.3	90	93.3	96.7	87.3
Mean		44.4	64.4	73.3	86.7	91.1	72
0.2	0.0	20	50	53.3	66.7	73.3	52.7
	5	20	43.3	53.3	70	83.3	54
	10	20	50	53.3	70	90	56.7
Mean		20	47.8	53.3	68.9	82.2	54.5
Total Mean		42.6	61.8	69.2	80.8	87.2	

Mean of BA

BA	0.0	21.1	42.2	52.2	68.9	73.9	50.7
	5	48.9	71.1	75.5	85.6	92.2	74.7
	10	57.8	72.2	80	87.8	95.6	78.8
Mean		42.6	61.8	69.2	80.8	87.2	68.3

L.S.D at 5% between IBA(I)=3.3,BA(B)=3.3,Period(P)=4.4,
B*P=6.1,I*B*P=7.9
I*B=5.1, I*P=6.1

Table(23): Rate of percentage increase of dry weight per one cutting as related to start sample during water culture incubation periods (interval increase percentage).

IBA PPm	BA PPm	start sample	Days of incubation					Total% increase	Mean
			7	14	21	28	35		
0.0	0.0	0.0	10.7	2.8	6.6	14.6	7.6	42.3	8.5
	5	0.0	5.9	4.6	2.3	5.8	8.0	26.6	5.3
	10	0.0	14.1	4.0	1.9	3.1	5.8	28.9	5.8
Mean		0.0	10.2	3.8	3.6	7.8	7.1	32.6	6.5
0.1	0.0	0.0	6.6	7.5	5.9	16.5	10.1	46.6	9.3
	5	0.0	4.2	5.8	2.0	7.2	9.5	28.7	5.7
	10	0.0	7.0	2.0	2.3	2.4	3.9	17.6	3.5
Mean		0.0	5.9	5.1	3.4	8.7	7.8	31.0	6.2
0.2	0.0	0.0	4.8	5.4	7.0	8.8	12.8	38.8	7.8
	5	0.0	12.4	2.2	1.1	4.1	9.3	29.1	5.8
	10	0.0	11.4	2.5	0.8	2.4	5.8	22.9	4.6
Mean		0.0	9.5	3.4	3.0	5.1	9.3	30.3	6.1
Total mean		0.0	8.5	4.1	3.3	7.2	8.1	31.3	

Mean of BA

BA	0.0	0.0	7.4	5.2	6.5	13.3	10.2	42.6	8.5
	5	0.0	7.5	4.2	1.8	5.7	8.9	28.1	5.6
	10	0.0	10.8	2.8	1.7	2.6	5.2	23.1	4.6
Total mean		0.0	8.6	4.1	3.3	7.2	8.1	31.3	

L.S.D at 5% between IBA(I) = 0.2
BA(B) = 0.2
Proid (P) = 0.3
I*B = 0.4
I*P = 0.4
B*P = 0.4
I*B*P = 1.2

ing 0.1 ppm IBA in the presence of 0.0 ppm. BA. such increment decreased gradually by ing the same rate of IBA, with increasing the rate of BA from 0.0 into 10 ppm.

ii) There is no clear trend of dry weight per one cutting proportion increments during fferent periods of incubation.

iii) As a general, there was two waves of dry weight accumulation in cutting, the first ccurred during the seven days, while the secend was shown from the period extended from 1 till 35. The first one seemed to be during the early period of root initution, while the econd one was during the root development stage.

iv) At any way it may be concluded that both of IBA and BA affected the dry matter ccumulation in ***Scindapsus aureus*** cuttings during the phase of water culture, and that ay be connected with the rate of root formation; the stage of the root initiation and the tage of root development. In other words, the proportion of metabolic process which lifferse by using both growth regulators, may play a role in the percentage of rooting bility of ***Scindapsus aureus***.

The complete success of the resulted cuttings is not defined by rooting ability at the end of water culture incubation, but defined by sprouting and shooting ability and the growth ehaviour under pot conditions of such leafy decorated plant. Accordingly, the norphological data was extended till 21 weeks from re-transplanted the rooted cuttings nder pot conditions.

e) Plant length during the course of pot stage (21 weeks from re-transplanting in pots) as affected by combined treatments with IBA and BA (Table, 24).

The following conclusions may by observed :

i) Irrespective to other factors, IBA stimulated plant length. Such stimulatory effect increased with increasing the rate of IBA from 0.1 to 0.2 ppm. However, BA depressed such length, and that increased by increasing its rate, at the end of marketable stage after 21 days from re - transplanting.

ii) BA minimized the stimulatory effect of IBA on shoot length, and that increase with increasing the rate of BA. with less effect when IBA used at the rate of 0.2 ppm.

Table (24): Plant length during the course of pot stage (21 weeks from re-planting in pots) as affected by the combined treatments with IBA and BA.

IBA PPm	BA PPm	Weeks under pot condtion							Mean
		3	6	9	12	15	18	21	
0.0	0.0	1.1	2.5	5.8	9.5	11.9	12.8	19.8	9.1
	5	1.4	2.4	6.4	9.8	12.3	13.0	15.8	8.7
	10	1.6	2.6	6.8	8.9	11.9	12.3	14.5	8.4
Mean		1.4	2.5	6.3	9.4	12.0	12.7	16.7	8.7
0.1	0.0	2.1	3.6	9.5	12.2	15.8	19.4	27.5	12.9
	5	2.3	3.3	7.2	10.4	13.6	15.7	22.5	10.7
	10	2.4	3.1	7.3	9.2	12.3	14.5	20.8	9.9
Mean		2.3	3.3	8.0	10.6	13.9	16.5	23.6	11.2
0.2	0.0	2.9	3.3	9.7	13.3	16.6	19.8	29.2	13.5
	5	2.7	3.1	6.4	12.6	15.5	17.3	24.7	11.8
	10	2.5	3.1	6.4	10.6	14.1	16.6	22.4	10.8
Mean		2.7	3.2	7.5	12.2	15.4	17.9	25.4	12.0
Total		2.1	3.0	7.3	10.7	13.8	15.7	17.9	10.6
						Mean of BA			
BA	0.0	2.0	3.1	8.3	11.7	14.8	17.3	25.5	11.8
	5	2.1	2.9	6.7	10.9	13.8	15.3	21.0	10.4
	10	2.2	2.9	6.8	9.6	12.8	14.5	19.2	9.7
Total mean		2.1	3.0	7.3	10.7	13.8	15.7	21.9	10.6

L.S.D at 5% between: IBA(I) = 0.3
BA (B) = 0.3
Proid (P) = 0.4
I*B = 0.6
I*P = 0.6
B*P = 0.6
I*B*P = 1.1

ii) The highest stem length was gained when IBA. was used at the rate of 0.2 ppm. in the esence of 0.0 ppm BA, while the lowest value was gained by using BA alone at the rate of) ppm.

iv) It could be concluded that the effect of both substances extended during shooting evelopment and affected the marketable shape of ***Scindapsus aureus*** after 21 days under ot conditions.

Number of new formed leaves/plant and leaf area during the course of pot stage, as ffcted by combined treatments with IBA and BA (Table, 25).

may be concluded the following conclusions:

i) It must be mentioned that the commertial decorated value comes from its number f leaves, their shape and size. As a general, and irrespective to any other factors IBA timulated higher formation of new leaves, the higher the rate of IBA the higher formation of new formed leaves of ***Scindapsus aureus*** was gained after 21 weeks under pot conditions. However, a contrast result was gained by using BA after 21 weeks.

ii) With regards to the combined effect of IBA and BA, it may be concluded that the ighest leaf formation was gained by using either BA at the rate of 5 ppm. with 0.0 ppm IBA or IBA at 0.1 or 0.2 ppm. in the presence of 0.0 ppm. BA. On the other hand, the lowest values was gained by using BA at the rate of 10 ppm. either in the presence of IBA at the rate of 0.0 or 0.1 ppm and that was clear after 21 weeks from re-transplanting.

iii) It may be concluded that both growth regulators seemed to have a role in the metabolic process leading to the formation of new leaves irregular and not significant in this respect.

iv) With regards to blade area per one leaf and whole plant leaf area after 21 weeks under pot culture conditions, marketable stage, as affected by different treatments one can conclude that different treatments affected such criteria. In addition, the highest whole plant leaf area was gained by using IBA at the rate of 0.1ppm. It must be mentioned that different treatments seemed to have a long term effect, i.e their effects on rooting ability were extended to include different morphological aspects during marketable stage.

g) Mean of new formed internode length during the course of pot stage (Table, 26).

It may by concluded that very slight effect of different treatments was obtained as all probable combinations were insignificant.

h) Fresh weight in different plant organs and its percentage distribution at the ıd of 21 weeks of pot stage as affected by combined treatments with IBA and BA Table, 27).

he following conclusions may be noticed:

i) As a general, and irrespective to other factors, leaf blade possessed the highest alue of fresh weight, followed in a descending order by leaf petiol; roots and stem. lowever, the proportion of fresh weight of root, stem and leaf petiol seemed to be more or ess similar in their frest weight proportion.

ii) IBA at the rate of 0.2 ppm seemed to minimize the fresh weight of whole plant ınder the levels of 0.0 or 0.1 ppm (irrespective to other factors). The same conclusion was ılso noticed by using BA.

iii) The highest amount of whole plant fresh weight was gained by using IBA at the ·ate of 0.1 ppm in the presence of 0.0 ppm BA, but the lowest one was gained by using 0.1 ppm IBA in the presence of 10 ppm BA.

iv) It may be concluded that IBA, BA or the combination with each other, changed greatly the proportion distribution of fresh weight in different plant organs, without clear trend in this respect.

i) Dry weight in different plant organs and its percentage distribution at the end of 21 weeks of pot stage as affected by combined treatments with IBA and BA (Table, 28)

i) The highest dry matter proportion was shown in leaves followed by stem, root and petiol in a descending order (irrespective to any other factors).

ii) IBA stimulated higher accumlation proportion of dry matter in roots and declined such proportion in stem and leaf petiole. However, BA seemed to have a troublness in the proportion of dry matter distribution in different plant organs.

Table (25): No. of new formed leaves/plant , leaf area and whole plant leaf area of *Scindapsus aureus* during the course of pot stage (21 weeks from re-plantaning in pots) as affected by the combined treatments with IBA and BA.

IBA PPm	BA PPm	Weeks under pot condtions							Mean	leaf area, and leaf(cm)² 21 weeks	whole plant leaf area/plant 21 weeks
		3	6	9	12	15	18	21			
0.0	0.0	1.4	2.2	3.3	3.6	5.8	6.4	7.0	4.2	40.1	280.7
	5	1.5	2.9	3.9	4.9	6.2	7.10	9.3	5.1	39.8	370.1
	10	1.5	2.9	3.1	3.4	5.4	6.2	6.8	4.2	58.1	395.1
Mean		1.5	2.7	3.4	4.0	5.8	6.6	7.7	4.5	46.0	348.6
0.1	0.0	1.9	3.1	3.9	5.0	6.0	6.9	9.5	5.2	46.7	443.7
	5	1.7	2.6	3.5	4.1	5.2	6.1	7.5	4.4	46.3	347.3
	10	1.3	1.9	2.8	3.3	3.9	4.0	6.8	3.4	51.6	350.9
Mean		1.6	2.5	3.4	4.1	5.0	5.7	7.9	4.3	48.2	380.6
0.2	0.0	2.1	2.9	3.9	4.5	5.4	6.8	9.3	5.0	40.4	375.7
	5	1.6	2.4	3.5	4.1	4.9	6.3	7.8	4.4	43.4	338.5
	10	1.2	1.8	2.6	3.4	3.8	5.4	7.8	3.7	48.8	380.6
Mean		1.6	2.4	3.3	4.0	4.7	6.2	8.3	4.4	44.2	364.9
Total		1.6	2.5	3.4	4.0	5.2	6.2	8.0	4.4	46.1	364.7
		Mean of BA									
BA	0.0	1.8	2.7	3.7	4.4	5.7	6.7	8.6	4.8	42.2	366.7
	5	1.6	2.6	3.6	4.4	5.4	6.5	8.2	4.6	43.2	352.0
	10	1.3	2.2	2.8	3.4	4.4	5.2	7.1	3.8	52.8	375.5
Total mean		1.6	2.5	3.4	4.1	5.2	6.1	8.0	4.4	46.1	364.7
L.S.D at 5% between:		IBA(I) = 0.1 BA(B)=0.1 proid(p)=0.2 I*B=0.3								1.2	7.3
		I*P = 0.3								1.2	7.3
		B*P = 0.3								-	-
		I*B*P = 0.4								2.1	10.2

Table (26): Mean of new formed internode length (Plant length/No. of internode) during the course of pot stage (21 weeks from re-planting in pots) as affected by the combined treatments with IBA and BA.

IBA (PPm)	BA (PPm)	Weeks under pot condtions							Mean
		3	6	9	12	15	18	21	
0.0	0.0	0.8	1.1	1.8	2.6	2.1	2.0	2.8	1.9
	5	0.9	0.8	1.6	2.0	2.0	1.8	3.1	1.7
	10	1.1	0.9	2.2	2.6	2.2	2.0	2.1	1.9
Mean		0.9	0.9	1.9	2.4	2.1	1.9	2.7	1.8
0.1	0.0	1.1	1.2	2.4	2.4	2.6	2.8	2.9	2.2
	5	1.4	1.3	2.1	2.5	2.6	2.6	3.0	2.2
	10	1.8	1.6	2.6	2.8	3.2	3.6	3.1	2.7
Mean		1.4	1.4	2.4	2.6	2.8	3.0	3.0	2.4
0.2	0.0	1.4	1.1	2.5	3.0	3.1	2.9	3.1	2.4
	5	1.7	1.3	1.8	3.1	3.2	2.7	3.2	2.4
	10	2.1	1.7	2.5	3.1	3.7	3.1	2.9	2.7
Mean		1.7	1.4	2.3	3.1	3.3	2.9	3.1	2.5
Total mean		1.3	1.2	2.2	2.7	2.7	2.6	2.9	2.2
Mean of BA									
BA	0.0	1.1	1.1	2.2	2.7	2.6	2.6	2.9	2.2
	5	1.3	1.1	1.8	2.5	2.6	2.4	3.1	2.1
	10	1.7	1.4	2.4	2.8	3.0	2.9	2.7	2.4
Total mean		1.4	1.2	2.1	2.7	2.7	2.6	2.9	2.2

L.S.D 5% between: IBA(I) = 0.1 BA(B)= 0.1 Period(p)= 0.2
I*B = N.S. I*p = N.S.
B*P = N.S.
I*B*P = N.S.

Table (27): Fresh weight/plant of different plant organs at the end of 21 weeks of pot stage and its distribution as affected by the combined treatments with IBA and BA.

IBA (PPm)	BA (PPm)	Fresh weight (gr/plant)				% destrbution				
		Root	stem	petiol	blade	whole plant	Root	stem	petiol	blade
0.0	0.0	2.60	3.03	3.65	5.52	14.80	17.6	20.5	24.7	37.3
	5	3.48	3.30	3.10	5.57	15.45	22.5	21.4	20.1	36.1
	10	2.78	3.08	3.23	5.84	14.93	18.6	20.6	21.6	39.1
Mean		2.95	3.14	3.33	5.64	15.06	19.6	20.8	22.1	37.5
0.1	0.0	3.60	3.78	4.00	6.89	18.27	19.7	20.7	21.9	37.7
	5	2.95	2.93	3.55	5.30	14.73	20.0	19.9	24.1	36.0
	10	3.40	2.13	2.53	4.02	12.08	28.1	17.6	20.9	33.3
Mean		3.32	2.95	3.36	5.40	15.03	22.6	19.4	22.4	35.7
0.2	0.0	2.90	3.03	2.93	5.32	14.18	20.5	21.4	20.7	37.5
	5	2.08	2.70	2.60	4.92	13.30	23.2	20.3	19.5	37.0
	10	3.35	2.55	3.10	5.62	14.62	22.9	17.4	21.2	38.4
Mean		3.11	2.76	2.88	5.29	14.04	22.2	19.7	20.5	37.6
Total mean		3.13	2.95	3.19	5.44	14.71	21.5	20.0	21.7	36.9
		Mean of BA								
BA	0.0	3.03	3.28	3.53	5.91	15.75	19.3	20.9	22.4	37.5
	5	3.17	2.98	3.08	5.26	14.49	21.9	20.5	21.2	36.4
	10	3.18	2.59	2.95	5.16	13.88	23.2	18.5	21.2	36.9
Total mean		3.13	2.94	3.19	5.44	14.71	21.5	20.0	21.6	36.9

L.S.D 5% between:

IBA(I)	= 0.2
BA(B)	= 0.2
Organ(O)	= 0.3
I*B	= 0.5
I*O	= 0.5
B*O	= 0.5
I*B*O	= N.S.

Table (28): Dry weight/plant of different plant organs at the end of 21 weeks of pot stage and its percentage distribution as affected by combined treatments with IBA and BA.

IBA (PPm)	BA (PPm)	Dry weight (gr/plant)				% destribution				
		Root	Stem	Petiol	Blade.	Whole plant	Root	Stem	Petiol	Blade
0.0	0.0	0.1933	0.4210	0.2419	0.4344	1.2906	15.0	32.6	18.7	33.7
	5	0.2187	0.4540	0.2098	0.4825	1.3644	16.0	33.3	15.4	35.4
	10	0.1662	0.3196	0.1827	0.4467	1.1152	14.9	28.7	16.4	40.1
Mean		0.1927	0.3952	0.2115	0.4545	1.2569	15.3	31.5	16.8	36.4
0.1	0.0	0.2373	0.4426	0.1351	0.5808	1.3958	17.0	31.7	9.7	41.6
	5	0.2158	0.3559	0.2290	0.4323	1.2330	17.5	28.9	18.6	35.1
	10	0.2773	0.3059	0.1904	0.3431	1.1167	24.8	27.4	17.1	30.7
Mean		0.2435	0.3681	0.1848	0.4521	1.2485	19.8	29.3	15.1	35.8
0.2	0.0	0.2368	0.3365	0.1849	0.4384	1.1966	19.8	28.1	15.5	36.6
	5	0.2318	0.3819	0.1954	0.4406	1.2497	18.5	30.6	15.6	35.3
	10	0.2452	0.3385	0.2080	0.4855	1.2772	19.2	26.5	16.3	38.0
Mean		0.2379	0.3523	0.1961	0.4548	1.2411	19.2	28.4	15.8	37.6
Total mean		0.2247	0.3729	0.1975	0.4538	1.2488	18.1	29.7	15.9	36.3
		Mean of BA								
BA	0.0	0.2225	0.400	0.1873	0.4845	1.2943	17.2	30.9	14.5	37.4
	5	0.2219	0.3973	0.2114	0.4518	1.2824	17.3	31.0	16.5	35.2
	10	0.2296	0.3213	0.1937	0.4251	1.1697	19.6	27.5	16.6	36.3
Total mean		0.2247	0.3729	0.1975	0.4538	1.2488	18.0	29.8	15.9	36.3

L.S.D 5% between: IBA(I) = 0.1
BA(B) = 0.1
Organ(O) = 0.1
I*B = 0.2
I*O = 0.2
Bx0=0.2 IxBx0=N.S.

) Combined effects of IBA and BA on some macro,-and micro-nutrients status in indapsus aureus:

As it was found that both used growth regulators and their probable combinations fected the root initiation, its formation and development, thus different nutrients uptake ay be greatly affected under these conditions. Accordingly, the study was extended to ver the status of some different macro-and micro-nutrients under both culture conditions, . at the end of water culture (35 days) and at the end of pot culture conditions (21 weeks ter transplanting the plantlets). These data include their concentration (mg/gr dry weight), tual amount (mg/plant), % increase as related to start sample and percentage distribution different plant organs as related to whole plant amount. It must be mentioned that the hole plant concentration was calculated on the basis of whole plant amount/on whole plant y weight. This study includes the status of: N, P, K, Ca and Mg from macro-nutrients and e, Zn, Mn and Cu from micro-nutrients. The proportions of different macro-to their total nounts as well as the different individual micro-to their total amount, and the proportion f macro-to micro-nutrient were also calculated to get some clue information about the alance of such nutrients in this type of semi-hydrophytic plant, as the data of different utrients requirements are very rare in this respect. These different data are tabulated in Tables from, 29 to 38).

J,a) Nitrogen (Table, 29).

The following conclusions may be observed:

- As a general, the concentration decreased under the start sample, while the actual mount of whole plant increased over the start sample, under different conditions of either vater or pot cultures. Such increments were proportionaly with the periods.

- As a general, the highest N concentration was found in roots and leaf blade ollowed by stem and leaf petiol without no clear differences between them. However, the ighest actual amount of N was found in leaf blade followed by stem, root, while that accumulated in leaf petiol ranked the fourth in this respect.

- As a general, the daily N requirement of ***Scindapsus aureus*** seemed to be about 0.063 mg/one cutting during water culture period (2.12 mg/35 days), while that was about

Table (29): Nitrogen status in *Scindapsus aureus* at the end of water culture period (after 35 days of incubation) and at the end of pot culture phase (after 21 weeks under pot culture conditions), in terms of N concentration (mg N/gr dry weight) actual amount (Total N, mg/plant), percentage increase as related to start sample, and percentage distribution in different plant organs as related to the amount of whole plant at the end of pot culture stage, as affected by the combined treatments with IBA and BA.

IBA (ppm)	BA (ppm)	N concentration (mg/gr dry wt.) pot culture period							Total N content (mg/plant) pot culture period							% increase as related to start sample		% increase at related to start sample		% distribution as related to whole plant (pot period)			
		start sample	water culture period	root	stem	l. petiol	l. blade	whole plant	start sample	water culture period	root	stem	l. petiol	l. blade	whole plant	w.c.m	p.c.m	w.c.m	p.c.m	root	stem	l. petid	l. blade
0.0	0	39.2	28.0	31.5	23.8	16.8	26.6	24.6	6.90	8.71	6.09	10.05	4.06	11.56	31.76	1.81	24.86	26.2	360.3	19.2	31.6	12.8	36.4
	5		26.6	24.5	21.9	14.7	30.1	24.1		7.27	5.34	9.94	3.08	14.52	32.88	0.37	25.98	5.4	376.5	16.2	30.2	9.4	44.2
	10		31.5	19.6	28.3	19.6	29.4	23.7		9.08	3.26	6.49	3.58	13.13	26.46	2.18	19.56	31.6	283.5	12.3	24.5	13.5	49.6
Mean			28.7	25.2	22.8	17.8	28.7	24.1		8.35	4.90	8.83	3.57	13.07	30.37	1.45	23.47	21.1	340.1	15.9	28.8	11.9	43.4
0.1	0		35.0	35.0	21.0	15.4	25.2	24.6	6.90	11.41	8.31	9.29	2.08	14.64	34.32	4.51	27.42	65.4	397.4	24.2	27.1	6.1	42.7
	5		30.8	31.5	20.5	20.3	26.6	25.1		9.49	7.55	7.30	4.57	11.50	30.92	2.59	24.02	37.5	348.1	24.4	23.6	14.8	37.2
	10		32.9	19.8	18.9	27.8	32.2	24.7		9.19	5.99	5.78	5.29	11.05	27.61	2.29	20.71	33.2	300.1	19.9	20.9	19.2	40.0
Mean			32.9	28.8	20.1	21.2	27.9	24.8		10.3	7.12	7.46	3.98	12.40	30.95	3.13	24.05	45.4	348.5	22.8	23.9	13.4	40.0
0.2	0		34.3	27.3	21.7	26.6	26.6	25.4	6.90	8.91	6.46	7.30	4.92	11.66	30.34	2.01	23.44	29.1	339.7	21.3	24.1	16.2	38.4
	5		30.8	32.2	18.9	20.3	27.2	24.5		7.93	7.46	7.22	3.97	11.98	30.63	1.83	23.73	14.9	343.9	24.4	23.6	13.0	39.1
	10		23.6	32.9	18.9	19.6	29.0	25.6		9.21	8.07	6.40	4.08	14.08	32.63	2.31	25.73	33.5	372.9	24.7	19.6	12.5	43.2
Mean			32.9	30.8	19.8	22.2	27.6	25.2		8.68	7.33	6.97	4.32	12.57	31.20	1.78	24.30	25.8	352.2	23.5	22.4	13.9	40.2
Total mean of B A																							
B A	0	39.2	32.4	31.3	22.2	19.6	26.1	24.9	6.90	9.68	6.95	8.88	3.69	12.62	32.14	2.78	85.24	40.2	365.8	21.6	27.6	11.7	39.2
	5		29.4	29.4	20.4	18.4	28.0	24.6		8.23	6.78	8.15	3.87	12.67	31.48	1.33	24.58	19.3	356.2	21.7	25.8	12.4	40.2
	10		32.7	24.1	19.4	22.3	30.2	24.7		9.16	5.61	6.22	4.32	12.75	28.90	2.26	22.00	32.8	318.8	19.0	21.7	15.1	44.3
Total mean			31.5	28.3	20.7	20.1	28.1	24.7		9.02	6.45	7.75	3.96	12.68	30.84	2.12	23.94	30.8	346.9	20.8	25.0	13.1	41.2

w w.c.end of water culture period; p.c. end of pot culture period.

14 mg weekly during pot culture period (23.94 mg/21 weeks), i.e 0.163 mg N daily, and at was proportionaly with the growth behaviour and its rate of the plant.

- With regards to the effect of IBA irrespective to any other factor on N ıncentration, it may be concluded that IBA seemed to stimulate such concentration at the ıd of water culture period as compared to those corresponding one received 0.0 ppm with ːry slight stimulatory effect at the end of pot culture period. In addition, the concentration ː N increased in root and leaf petiole and decreased in stem and leaf blade under the eatment with IBA. The same conclusion was mostly observed with actual amount of N per ıant organ. Accordingly, IBA seemed to disturb the proportion balance of N in different lant organs at the end of pot culture stage.

- With regards to the effect of BA on N concentration, irrespective to other factors, /hole plant N concentration seemed to be constant as compared to 0.0 ppm. However, the oncentration of N in different plant organs seemed to be affected by the tested BA rates.

- With regards to the combined effect of IBA and BA, the trend of nitrogen oncentration seemed to be irregular. However, it may concluded that BA minimized the timulatory effect of IBA on nitrogen total content for some degree especially when IBA vas used at 0.1 ppm. In addition, the combined effect of IBA and BA regulated greatly the ɔercentage distribution of N in different plant organs.

'J,b) Phosphorus (Table, 30)

It may concluded the following:

- The P content increased at the end of water culture period as well as at the end of pot culture phase when compared to the start sample.

- As a general, stem posseed the highest P concentration followed by root while leaf petiol and blade ranked the third in this respect.

- The actual amounts of P indicate that ***Scindapsus aureus*** cutting absorbed great amount of P either during water culture period (258.3% as related to start sample) or during pot culture phase which reached to 1327.2% (the total mean value). This finding may be discussed on the bases that new initiated and developed organs required higher amounts of energy, thus the developed cutting absorb higher amounts of P. In addition, the

Table (30): Phosphorus status in *Scindapsus aureus* at the end of water culture period (after 35 days of incubation) and at the end of pot culture phase (after 21 weeks under pot culture conditions), in terms of P concentration (mg P/gr dry weight) actual amount (Total P, mg/plant), percentage increase as related to start sample, and percentage distribution in different plant organs as related to the amount of whole plant at the end of pot culture stage, as affected by the combined treatments with IBA and BA.

IBA (ppm)	BA (ppm)	P concentration (mg/gr dry wt.) pot culture period						Total P content (mg/plant) pot culture period						% increase as related to start sample		% increase at related to start sample		% destribution as related to whole plant (pot period)			
		start sample	water culture period	root	stem	l. petiol	l. blade	whole plant	start sample	water culture period	root	stem	l. petiol	l. blade	whole plant	w.c.*	p.c.*	w.c.*	p.c.*	root	stem	l. petiol	l. blade
0.0	0	0.99	2.01	1.66	1.89	1.82	1.69	1.78	0.174	0.626	0.321	0.798	0.440	0.734	2.293	0.452	2.119	259.8	1217.8	14.0	34.8	19.2	32.1
	5		1.09	1.45	2.04	1.79	2.01	2.02		0.298	0.316	1.090	0.376	0.970	2.752	0.124	2.578	71.3	1481.6	11.5	39.6	13.7	35.2
	10		1.06	1.47	2.01	1.32	1.36	1.56		0.305	0.244	0.642	0.241	0.608	1.735	0.131	1.561	75.3	897.1	17.6	37.0	13.9	35.0
Mean			1.39	1.53	1.98	1.64	1.69	1.79		0.410	0.294	0.843	0.352	0.771	2.260	0.236	2.086	135.5	1198.8	14.4	37.1	15.6	34.1
0.1	0		1.35	3.04	2.64	1.84	1.69	2.24		0.440	0.721	1.168	0.249	0.982	3.120	0.266	2.946	152.9	1693.1	14.1	37.4	8.0	31.5
	5		2.84	2.64	2.10	1.50	1.67	1.93		0.875	0.570	0.747	0.338	0.722	2.377	0.701	2.203	402.9	1266.1	24.0	31.4	14.2	30.4
	10		1.22	2.01	1.22	1.62	2.84	1.98		0.341	0.557	0.373	0.308	0.974	2.212	0.167	2.038	96.0	1171.3	25.2	16.9	13.9	44.0
Mean			1.87	2.56	1.99	1.65	2.07	2.05		0.552	0.616	0.763	0.298	0.893	2.270	0.378	2.396	217.3	1376.8	21.1	28.6	12.8	35.3
0.2	0		1.49	1.95	1.95	1.97	1.62	1.82		0.387	0.462	0.656	0.346	0.710	2.174	0.213	2.000	122.4	1149.4	21.3	30.2	15.9	32.7
	5		1.42	2.84	2.84	1.84	1.67	2.26		0.366	0.658	1.085	0.340	0.736	2.819	0.192	2.645	110.3	-520.1	23.3	38.5	12.1	26.1
	10		0.89	1.62	3.04	0.64	1.84	2.25		0.244	0.397	1.029	0.549	0.893	2.868	0.070	2.694	40.2	1548.3	13.8	35.9	19.1	31.1
Mean			1.27	2.14	2.61	2.15	1.71	2.11		0.332	0.506	0.923	0.412	0.780	2.620	0.138	2.446	422.8	1405.9	19.5	34.9	15.7	30.0

Total mean of B A

B A	0		1.62	2.22	2.16	1.88	1.67	1.95		0.484	0.501	0.874	0.345	0.809	2.529	0.310	2.355	178.4	1353.4	16.5	34.1	14.4	32.1
	5		1.78	2.31	2.33	1.71	1.78	2.07		0.513	0.515	0.974	0.351	0.809	2.649	0.339	2.475	525.9	1422.6	19.6	36.5	13.3	30.6
	10		1.06	1.70	2.09	1.86	2.01	1.93		0.297	0.399	0.681	0.366	0.825	2.271	0.123	2.098	70.5	1205.6	18.9	29.9	15.6	36.7
Mean			1.49	2.08	2.19	1.82	1.82	1.98		0.431	0.472	0.843	0.354	0.814	2.483	0.257	2.309	258.3	1327.2	18.3	33.5	14.4	33.1

* w.c. end of water culture period ; p.c. end of water culture period

ily absorbed amount of P seemed to be about 0.0073 mg P/day during water culture riod (0.257mg. P /35days) and about 0.1100 mg P/week during pot culture phase (0.0157 g P/day). The fail of growing ***Scindapsus aureus*** under the home conditions may be lated partially to the lack of different balanced nutrients in the growing medium, such as as our results indicated that during the phase of growth ***Scindapsus aureus*** required latively higher amount of P.

- The higher proportion of P was found in stem followed by blade, roots while leaf etiol ranked the fourth in this respect (33.5, 33.1, 18.3 and 14.4 respectively).

- With regards to the effect of IBA, irrespective to other factors, on P concentration, could be stated that 0.1 ppm IBA stimulated this concentration at the end of water culture eriod, while 0.2 ppm IBA declined such concentration when compared to. 0.0 ppm IBA. lowever, at the end of pot culture stage the stimulatory effect of IBA increased with ncreasing its rate with great variable effect on P concentration in different plant organs. The ame conclusion was observed in the actual amounts. In addition, IBA seemed to increase greatly the absorption of P during both culture phase, and that was proportional with IBA ate. In other words, IBA at the rate of 0.1 ppm doubling the proportion of percentage ncrease in P over 0.0 ppm at the end of water culture periods, while IBA at 0.2 ppm. seemed to be doubling the propertion increase of P as combared to the corresponding one of 0.1 ppm IBA. This phenomenon was extended to pot culture phase. In addition, IBA troubled or regulated the accumulation proportion of P in different plant organs, as great variable effect was observed in percentage distribution of P in different plant organs at the end of pot culture phase.

- With regards to the effect of BA on the status of P, it may be concluded that 5 ppm BA increased slightly P concentration, and actual amount per plant, while 10 ppm BA declined slightly such concentration, when compared with the corresponding one received 0.0 ppm BA. On the other hand, BA application distrub the percentage distribution of P in different plant organs.

- With regards to the combined effect of IBA and BA, it may be concluded that BA declined the stimulatory effect of 0.1 ppm IBA on the concentration and the actual amount

P. However, under 0.2 ppm IBA the ***vice versa*** may be mostly true. In addition, the ımbined effect of IBA and BA disturbed the percentage distribution of P in different plant gans.

,c) Potassium (Table, 31)

As a general the different treatments disturbed the concentration, actual amount and e percentage distribution of K in different plant organs. As in N and P, the K status ıowed no clear trend by using IBA and BA and their probable combinations. IBA at 0.1 ɔm stimulate the accumulation of K while IBA at 0.2 decreased such accumulation in ***cindapsus aureus***.

BA showed no clear trend, but both IBA and BA disturbed the accumulation of K in ifferent plant organs. In addition BA changed greatly the effect of IBA on the ccumulation of K without no clear trend.

Leaf blade possessed the highest K proportion followed by leaf petiole, stem while oots ranked the fourth in this respeet. This may be discussed on the basis that K plays an nportant role on carbohydrate metabolism in leaf blade, but its main role in leaf petiol is the ontrol of cell turgidity and may be played an important role for the control of the direction ɔf leaf blade.

'J,d) Calcium Table (32)

It may be concluded that Ca status in ***Scindapsus aureus*** seemed to be more or less he same changed trend as related to the different treatments, as discussed before in N, P ınd K. Both IBA and their combination disturbed the accumulation of Ca in different plant organs, and that may play a part in the growth behaviour under such treatments. The highest Ca proportion was found in leaf blade followed by stem, root while leaf petiol ranked the fourth in this respect.

(J,e) Magnesium (Table, 33)

As Mg in ***Scindapsus aureus*** is very fine, it was calculated as microgram instad mg. The lower relatively amount of Mg in such variegated plants seemed to be one of their

Table (31): Potassium status in *Scindapsus aureus* at the end of water culture period (after 35 days of incubation) and at the end of pot culture phase (after 21 weeks under pot culture conditions), in terms of K concentration (mg K/gr dry weight) actual amount (Total K, mg/plant), percentage increase as related to start sample, and percentage distribution in different plant organs as related to the amount of whole plant at the end of pot culture stage, as affected by the combined treatments with IBA and BA.

IBA (PPm)	BA (PPm)	K concentration (Mg/gr dry wt.) pot culture period							Total K (Mg/plant) pot culture period							Increase as related to start sample		% increase as related to start sample		% destribution as related to whole plant			
		Start-ing sample	Water culture period	Root	Stem	l. petiol	l. blade	whole plant	Start-ing sample	Water culture period	Root	Stem	l. petiol	l. blade	whole plant	w.c.*	p.c.*	w.c.*	p.c.*	root	stem	l. petiol	l. blade
0.0	0	39.70	33.1	30.5	26.0	74.5	42.6	41.4	6.81	10.30	5.90	10.95	10.02	18.51	53.38	3.49	46.57	51.2	683.8	11.1	20.5	33.8	34.7
	5		27.5	32.4	18.1	61.6	30.8	31.6		7.52	7.07	8.22	12.92	14.86	43.07	0.71	36.26	10.4	532.5	16.4	19.1	30.0	34.5
	10		25.8	29.2	40.5	93.1	51.5	52.2		7.43	4.83	12.94	17.37	23.01	58.17	0.62	51.86	9.1	754.2	8.3	22.2	29.9	39.6
Mean			28.8	30.7	28.2	77.1	40.4	41.7		8.42	5.94	10.70	16.10	18.79	51.54	1.61	23.6	23.6	656.8	11.9	20.6	31.2	36.3
0.1	0		33.0	31.7	31.2	86.7	38.8	39.8		10.76	7.52	13.81	11.71	22.34	55.38	3.95	48.77	58.0	716.1	13.5	24.8	21.1	40.6
	5		35.1	30.5	27.6	84.6	40.7	43.3		10.81	6.58	9.82	19.37	17.59	53.36	4.00	46.55	58.7	683.6	12.3	18.4	36.3	33.0
	10		30.1	32.8	20.4	119.7	41.6	46.9		8.40	9.10	6.24	22.79	14.27	52.40	1.59	45.59	23.3	669.5	17.4	11.9	43.5	27.2
Mean			32.7	31.7	26.4	97.0	33.9	43.3		9.99	7.73	9.96	17.96	18.13	53.78	3.18	46.97	46.7	689.7	14.4	18.4	33.6	33.6
0.2	0		29.0	19.6	36.2	95.8	39.9	43.6		7.53	4.64	12.18	17.71	17.58	52.11	0.72	45.30	10.6	665.2	8.9	23.4	34.0	33.7
	5		28.8	30.0	21.0	88.7	35.3	37.0		7.42	6.95	8.02	15.76	15.55	46.28	0.61	39.47	9.0	579.6	15.0	17.3	34.1	33.6
	10		29.1	24.1	22.4	84.5	41.3	46.0		7.98	5.91	7.58	17.58	20.05	51.12	1.17	44.31	17.2	650.7	11.6	14.8	34.4	39.2
Mean			27.6	24.6	26.5	83.7	44.8	46.2		7.64	5.83	9.26	17.82	17.73	49.84	0.83	43.03	12.3	631.8	11.8	18.5	34.2	35.5
Total mean of BA																							
B A	0		31.7	27.3	31.1	85.7	40.4	41.6		9.53	6.02	12.31	15.81	19.54	53.69	2.72	46.88	39.9	688.4	11.2	22.9	29.6	36.3
	5		29.1	31.8	22.2	72.3	33.9	37.3		8.58	6.87	8.69	16.82	16.00	47.57	1.77	40.76	26.0	598.6	14.6	18.3	33.5	33.7
	10		28.3	28.7	27.8	99.8	44.8	46.4		7.94	6.62	8.92	19.25	19.11	53.90	1.13	47.09	16.5	691.5	12.4	16.3	35.9	35.3
Total mean			29.7	29.0	27.0	85.9	39.7	41.8		8.68	6.50	9.97	17.03	18.22	51.72	1.87	44.91	27.5	659.2	12.7	19.2	33.0	35.1

* W.C. = end of water culture period ; P.C. = end of pot culture period.

Table (33): Magnesium status in *Scindapsus aureus* at the end of water culture period (after 35 days of incubation) and at the end of pot culture phase (after 21 weeks under pot culture conditions), in terms of Mg concentration (µg Mg/gr dry weight) actual amount (Total Mg, mg/plant), percentage increase as related to start sample, and percentage distribution in different plant organs as related to the amount of whole plant at the end of pot culture stage, as affected by the combined treatments with IBA and BA.

IBA (ppm)	BA (ppm)	Mg concentration (ug/gr drywt.) pot culture period						Total Mg (ug/plant) pot culture period							% increase as related to start sample		% increase as related to start sample		% destribution as related to whole plant (pot period)			
		start sample	water culture period	root	stem	l.petiol	l.blade	whole plant	start sample	water culture period	root	stem	l.petiol	l.blade	whole plant	w.c.*	p.c.*	w.c.*	p.c.*	root	stem	l.petiol	l.blade
0.0	0	2950	2763.0	1110.0	875.0	920.00	1215.0	1033.1	519.2	859.8	214.6	368.4	222.5	527.8	1333.3	340.6	814.1	65.6	156.8	16.1	27.6	16.7	39.6
	5		2200.0	1277.5	1100	1297.0	1300.0	1300.4		601.5	278.7	499.4	272.3	723.8	1774.2	82.3	1255.0	15.9	241.7	15.7	28.1	15.3	40.8
	10		2250.0	1200.0	1065	815.00	1592.5	1256.6		648.2	199.4	340.4	148.9	711.6	1400.3	129.0	891.1	24.8	169.7	14.2	24.3	10.6	50.9
Mean			2404.0	1195.8	1013	994.2	1436.8	1196.4		703.2	230.9	402.7	214.6	654.4	1502.6	184.0	983.4	35.4	189.4	15.3	26.7	14.2	43.7
0.1	0		276.3	925.00	1157	1112.5	1525.0	1266.7		900.7	219.5	512.5	150.4	885.7	1768.1	381.5	1248.9	73.5	240.5	12.4	29.0	8.5	50.1
	5		2575.0	1087.5	950	1180.0	1495.0	1208.0		793.4	234.8	338.1	270.2	646.3	1489.4	274.5	970.2	52.9	186.9	15.8	22.7	18.1	43.4
	10		2988.0	440.00	890	1275.0	1585.0	1057.5		834.2	122.8	222.3	242.8	543.8	1180.9	315.0	661.7	60.7	127.4	10.3	23.1	20.6	46.0
Mean			2775.0	817.5	999	1189.2	1535.0	1177.4		842.8	192.1	374.3	221.1	691.9	1479.5	323.7	960.3	62.4	184.9	12.8	24.9	15.7	46.5
0.2	0		2500.0	440.0	337	665.00	745.00	553.3		649.3	104.2	113.7	122.4	326.6	666.9	130.1	147.7	25.1	28.4	15.6	17.0	18.4	49.0
	5		3088.0	718.0	440	755.00	1000.0	736.7		795.2	164.6	168.6	147.5	440.6	920.7	276.0	401.5	53.2	77.4	17.9	18.2	16.0	47.9
	10		2463.0	785.0	470	745.00	1347.5	909.1		6754	192.5	159.1	155.0	654.5	1161.1	156.2	641.9	30.1	123.6	16.6	13.7	13.3	56.4
Mean			2684.0	645.0	416	721.7	1031.8	733.0		706.6	153.8	146.9	141.6	473.9	916.2	187.4	397.0	36.1	76.5	16.7	16.3	15.9	51.1
Total mean of B A																							
B A	0		2675.0	825.0	790.0	899.2	1161.7	951.0		803.3	179.4	331.5	165.1	580.0	1256.1	284.1	736.9	54.7	141.9	14.7	24.5	14.5	46.2
	5		2621.0	1025.0	830.0	1060.8	1331.7	1081.7		730.1	226.0	335.2	230.0	630.6	1394.8	210.9	875.6	40.7	168.7	16.5	23.0	16.5	44.0
	10		2567.0	808.3	808.3	945.0	1508.3	1074.1		719.3	171.3	257.3	182.2	636.7	1247.4	200.1	728.2	38.5	140.2	13.7	20.4	14.8	51.1
Total mean			2621.0	886.1	809.4	968.3	1333.9	1035.6		750.9	192.2	308.0	192.4	606.8	1299.4	231.7	780.2	44.6	150.3	15.0	22.6	15.3	47.1

* W.C end of water culture period ; P.C.: end of pot culture period.

ıaracters, as the white yellowish spots are free from chlorophylls.

Leaf blade possessed the highest proportion of Mg followed by stem (green stem), 'hile there are no clear differences between root and leaf petiol, in Mg proportion.

The treatments with IBA, BA and their probable combinations affected greatly the 1g status in different plant organs. The application of IBA, irrespective to other factors, eclined the absorption of Mg and disturbed the proportion distribution of such element in ifferent plant organs. This decline effect of IBA may be cheked by the application of BA.

The daily requirment of Mg seemed to be relatively low comparing to N, Ca, K or P.

J, f) Iron (Table, 34):

It may conclude the following conclusions:

- Root possesed the highest Fe proportions followed by leaf blade, stem and leaf ɔetiole ranked the fourth in this respect.

- The requirment of this type of plants from Fe seemed to be relatively very low, as :he daily requirement from Fe during water culture periods seemed to be about 1.14 µg per plant (39.39 µg Fe/35 days), and 1.235 µg daily during pot culture period (181.5 µg Fe/147 days).

- IBA seemed to stimulate the accumulation and uptake of Fe in ***Scindapsus aureus*** under the conditions of this experiment, while BA seemed to increase such accumulation only under the low rate (5ppm). However, 10 ppm BA seemed to decrease such accumulation. In addition, both growth regulators troubled greatly the accumulation of Fe and its uptake, as the changes in Fe content greatly varied without regular trend in different plant parts.

(J, g) Zinc (Table, 35):

As a general the highest Zn proportion was found in stem followed by root, leaf blade and finally leaf petiole. The daily requirement of Zn by ***Scindapsus aureus*** is very low during water culture periods (3.55 µg during 35 days), and this requirement was about 0.867 µg daily during pot culture periods.

Table (34): Iron status in *Scindapsus aureus* at the end of water culture period (after 35 days of incubation) and at the end of pot culture phase (after 21 weeks under pot culture conditions), in terms of Fe concentration (µg I/gr dry weight) actual amount (Total Fe, mg/plant), percentage increase as related to start sample, and percentage **distribution** in different plant organs as related to the amount of whole plant at the end of pot culture stage, as affected by the combined treatments with IBA and BA.

IBA (ppm)	BA (ppm)	Fe concentration (mg/gr dry wt.) pot culture period: start sample	water culture period	root	stem	l. petiol	l. blade	whole plant	Total Fe (ug/plant) pot culture period: start sample	water culture period	root	stem	l. petiol	l. blade	whole plant	% increase as related to start sample: w.c.*	p.c.*	% increase at related to start sample: w.c.*	p.c.*	% des trilaution as related to whole plant (pot period): root	stem	l. petiol	l. blade
0.0	0	1124	838	595	113	163	191	221	197.8	260.8	115.0	47.4	39.4	82.8	284.6	62.8	86.8	31.7	43.9	40.4	16.7	13.8	29.1
	5		1051	543	120	188	245	242		287.1	118.4	54.5	39.4	118.2	330.5	89.6	132.7	45.3	67.1	35.8	16.5	11.9	35.8
	10		718	690	143	105	213	246		204.6	114.7	45.7	19.2	95.1	274.7	6.8	76.9	3.4	38.9	41.8	16.6	7.0	34.6
Mean			866	609	125	152	216	236		250.9	116.0	49.2	32.7	98.7	296.7	53.1	98.8	26.8	50.0	39.3	16.6	10.9	33.2
0.1	0		970	613	103	298	355	315		316.2	147.8	45.6	40.3	206.2	439.9	118.4	242.1	59.9	122.4	33.6	10.4	9.2	46.9
	5		750	700	273	228	301	349		231.1	151.2	97.2	52.1	129.9	430.4	33.3	232.6	16.8	117.6	35.1	22.6	12.1	30.2
	10		750	550	198	313	375	357		201.4	152.2	57.8	59.6	128.7	398.3	11.6	200.5	5.9	101.4	38.2	14.5	15.0	32.3
Mean			823	621	191	280	344	340		252.2	150.4	66.9	50.7	154.9	432.7	54.4	225.1	27.5	113.8	35.6	15.8	12.1	36.5
0.2	0		793	858	120	223	258	333		205.9	203.2	40.4	41.2	113.1	397.9	8.1	200.1	4.1	101.2	51.1	10.2	10.4	28.4
	5		838	693	283	243	288	355		215.8	160.6	108.1	47.5	126.9	443.1	17.9	245.3	9.0	124.0	36.2	24.4	10.7	28.6
	10		760	563	225	255	303	324		208.4	138.0	76.2	53.0	147.1	414.3	10.6	216.5	5.4	109.3	33.3	18.4	12.8	35.5
Mean			797	709	209	248	283	337		210.0	167.3	74.9	47.2	129.0	418.4	12.2	220.6	6.2	111.6	40.2	17.7	11.3	30.8
Total mean of B A																							
B A	0	39.2	867	689	112	228	268	290		260.9	155.3	44.5	40.3	134.0	374.1	63.1	176.3	31.9	89.2	41.7	12.4	11.1	34.8
	5		880	645	225	228	278	315		244.7	143.4	86.6	46.3	125.0	411.1	46.9	203.5	23.7	102.9	35.7	21.2	11.6	31.5
	10		740	601	189	224	297	309		207.5	135.0	59.9	43.9	123.6	362.4	9.7	164.6	4.9	83.3	37.8	16.5	11.6	34.1
Total mean			829	643	175	224	281	305		237.7	144.6	63.7	43.5	127.5	382.5	39.9	181.5	20.2	91.8	38.4	16.7	11.4	33.5

* W.C. = end of water culture period, P.C. = end of pot culture period

Table (35): Zinc status in *Scindapsus aureus* at the end of water culture period (after 35 days of incubation) and at the end of pot culture phase (after 21 weeks under pot culture conditions), in terms of Zn concentration (µg/gr dry weight) actual amount (Total Zn, mg/plant), percentage increase as related to start sample, and percentage distribution in different plant organs as related to the amount of whole plant at the end of pot culture stage, as affected by the combined treatments with IBA and BA.

IBA (ppm)	BA (ppm)	Zn concentration (mg/gr dry wt.) start sample	Zn concentration (mg/gr dry wt.) water culture period	Zn concentration (mg/gr dry wt.) pot culture period: root	stem	petiol	blade	whole plant	Total Zn (mg/plant) start sample	Total Zn (mg/plant) water culture period	Total Zn (mg/plant) pot culture period: root	stem	petiol	blade	whole plant	% increase as related to start sample: w.c.*	p.c.*	% increase as related to start sample: w.c.*	p.c.*	% destribution as related to whole plant (pot period): root	stem	petiol	blade
0.0	0	23.25	15.75	250.0	47.50	67.50	52.50	83.20	4.09	4.900	49.30	20.0	16.3	22.8	107.4	0.81	103.31	19.80	2525.9	45.00	18.6	15.2	21.2
	5		27.50	247.5	82.50	100.0	67.50	106.4		7.520	54.00	37.5	21.0	32.6	145.1	3.43	141.01	83.90	3447.7	37.20	25.8	14.5	22.5
	10		25.75	265.0	175.0	135.0	82.50	135.9		7.420	34.10	55.9	24.7	36.9	151.6	3.33	147.51	81.40	3606.6	22.50	36.9	16.3	24.3
Mean			23.00	234.2	101.7	100.8	67.50	108.5		6.610	45.5	37.8	20.7	30.8	134.7	2.52	130.61	61.7	3193.4	34.90	27.1	15.3	22.7
0.1	0		33.25	265.0	92.50	120.0	65.00	102.8		10.84	48.60	40.9	16.2	37.8	143.5	6.75	139.41	165.0	3408.6	33.90	28.5	11.3	26.3
	5		21.75	147.5	105.0	122.5	75.00	105.3		6.700	31.90	37.4	28.1	32.4	129.8	2.61	125.71	63.80	3073.6	24.60	28.8	21.6	25.0
	10		25.75	105.0	130.0	145.0	50.00	101.8		7.190	29.10	39.8	27.6	17.2	113.7	3.10	109.61	75.80	2680.0	25.60	35.0	24.3	15.1
Mean			26.92	152.5	109.2	129.2	63.30	103.3		8.240	36.50	39.4	24.0	29.1	129.0	4.15	124.91	101.5	3054.1	28.00	30.8	19.1	22.1
0.2	0		32.50	112.5	132.5	92.50	52.50	93.00		8.440	26.60	44.6	17.1	23.0	111.3	4.35	107.21	106.4	2621.3	23.90	40.1	15.4	20.7
	5		31.75	117.5	130.0	100.0	60.00	98.20		8.180	27.20	49.6	19.5	26.4	122.7	4.09	118.61	100.0	2900.0	22.20	40.4	15.9	21.5
	10		27.50	162.5	170.0	127.5	72.50	124.5		7.540	39.80	57.5	26.5	35.2	159.0	3.45	154.91	84.40	3787.5	25.00	36.2	16.7	22.1
Mean			30.58	130.8	144.2	106.7	61.70	105.2		8.050	31.20	50.6	21.0	28.2	131.0	3.96	126.91	96.90	3102.9	23.70	38.9	16.0	21.4
Total mean of B A																							
B A	0		27.17	189.2	90.80	93.30	56.70	93.00		8.060	41.20	35.2	16.5	27.9	120.7	3.97	116.64	97.10	2851.9	34.30	29.1	14.0	22.7
	5		27.00	170.8	105.8	107.5	67.50	103.3		7.470	37.70	41.5	22.9	30.5	132.5	3.38	128.44	82.60	3140.4	28.00	31.7	17.3	23.0
	10		26.33	157.5	150.3	135.8	68.30	120.7		7.380	34.30	51.1	26.3	29.8	141.4	3.29	137.34	80.50	3358.0	24.40	36.6	19.1	20.5
Total mean			26.83	172.5	118.3	112.2	64.20	105.7		7.640	37.70	42.6	21.9	29.4	131.5	3.53	127.47	86.70	3116.8	28.90	32.3	16.8	22.1

* w.c. end of water culture period, p.c. end of pot culture period.

It may be concluded also that great variation in the trend of Zn accumulation and ıtake by the use of IBA, BA or their probable combinations.

', h) Manganese (Table, 36):

The highest Mn proportion was found in leaf blade followed by stem, leaf petiole ıd finally root Mn proportion was the lowest in this respect. In addition, the daily Mn :quirement was relatively higher than Zn or Fe especially during pot culture periods.

Treatments with IBA, BA or their combinations changed greatly the accumulation nd uptake of Mn in different plant tissues without regular trend.

J, i) Cupper (Table, 37):

Leaf blade possessed the highest Cu proportion followed by leaf petiole, stem and inally root. The daily uptake of Cu seemed to be very minute compared to other micro ıutrients. In addition, and as in other nutrients IBA, BA or IBA * BA changed greatly the ıccumulation and the uptake of Cu.

From the different foregoing results the following conclusion may be observed:

- The accumulation of every nutrient is differed according to the role of such nutrient and the plant organs, as the propertion of every nutrient seemed to vary in plant organ.

- Great variation in the changes of every tested elements was obtained according to the application of IBA, BA or their probable combinations. Thus, it may conclude that the effect of such substances on plant growth was partially due to their effect on the different accumulation and uptake of different nutrients.

- According to such results, the balance between such nutrients in plant tissues may play a part in the regularity of plant growth. Thus our study was extended to cover this point.

Proportion of macro-and micro nutrients as related to their total amounts (Table, 38).

It could be concluded the following conclusions:

- As a general calcuem is the most abundant element in ***Scindapsus aureus*** followed by nitrogen, potassium magnesium and finally phosphorus. This is true during water culture

Table (36): Manganes status in ***Scindapsus aureus*** at the end of water culture period (after 35 days of incubation) and at the end of pot culture phase (after 21 weeks under pot culture canditions), in terms of Mn concentration (mg/gr dry weight) actual amount (Total Mn, mg/plant), percentage increase as related to start sample, and percentage distribution in different plant organs as related to the amount of whole plant at the end of pot culture stage, as affected by the combined treatments with IBA and BA.

IBA (ppm)	BA (ppm)	Mn concentration (mg/gr dry wt.) pot culture period							Total nantent (mg/plant) pat culture period							% increase as related to start sample		% increase as related to start sample		% destribution as related to whole plant (pat period)			
		start sample	water culture period	root	stem	l. petiol	l. blade	whole plant	start sample	water culture period	root	stem	l. petiol	l. blade	whole plant	w.c.w	p.c.w	w.c.w	p.c.w	root	stem	l. petiol	l. blade
0.0	0	208	210	208	288	460	590	410	36.6	65.4	40.2	121.2	111.3	256.3	529.0	28.8	492.4	78.70	1345.4	7.60	22.9	21.0	48.4
	5		200	263	323	553	553	433		54.7	57.4	151.2	116.0	266.8	591.4	18.1	554.8	49.50	1515.8	9.70	25.6	19.6	45.1
	10		180	233	318	520	533	439		51.9	55.3	101.6	95.00	238.1	490.0	15.3	453.0	41.00	1237.7	11.3	20.7	19.4	48.6
Mean			197	235	310	511	559	427		57.3	51.0	124.7	107.4	253.7	536.8	20.7	500.1	56.7	1366.3	9.50	23.1	20.0	47.4
0.1	0		240	258	263	460	548	400		78.2	61.2	116.4	62.10	318.3	558.0	41.6	521.4	113.7	1424.6	11.0	20.9	11.1	57.0
	5		195	165	338	460	543	402		60.1	35.6	120.3	105.3	234.7	495.9	23.5	459.3	84.20	1254.9	7.20	24.3	21.2	47.3
	10		150	123	290	433	513	341		41.9	34.1	88.70	82.40	176.0	381.2	5.30	344.6	14.50	941.50	8.90	23.3	21.6	46.2
Mean			195	182	297	451	535	381		60.1	43.6	108.5	83.30	243	478.4	23.5	441.8	64.10	1207.0	9.00	22.8	17.8	50.2
0.2	0		168	183	168	443	513	340		43.6	43.3	56.50	81.90	224.9	406.6	7.00	370.0	19.10	1010.9	10.6	13.9	20.1	55.3
	5		308	125	260	458	461	337		79.3	29.8	99.30	89.50	203.1	420.9	42.7	384.3	116.7	1050.0	6.9	23.6	21.3	48.3
	10		318	100	215	443	400	300		87.2	24.5	72.80	92.10	194.2	383.6	50.6	347.0	138.3	948.10	6.4	19.0	24.0	50.6
Mean			265	136	214	448	458	326		70.0	32.3	76.20	87.80	207.4	403.7	33.4	367.1	91.40	1003.0	8.0	18.8	21.8	51.4
B A	0		206	216	240	454	550	383		62.4	48.2	98.00	85.10	266.5	497.9	25.8	461.3	70.50	1260.3	9.7	19.2	17.4	53.6
	5		234	184	307	490	519	391		64.7	40.7	123.6	103.6	234.9	502.7	28.1	466.1	76.80	1273.6	7.9	24.5	20.7	46.9
	10		216	152	274	465	482	360		60.3	38.0	87.70	89.80	202.8	418.3	23.7	381.5	64.90	1042.4	8.9	21.0	21.7	48.5
Total mean			219	184	274	470	517	378		62.5	42.3	103.1	92.80	234.7	473.0	25.9	436.3	70.70	1192.1	8.8	21.6	19.9	49.7

w.c. = end of water culture period. p.c. = end of pot culture period.

Table (37): Cupper status in *Scindapsus aureus* at the end of water culture period (after 35 days of incubation) and at the end of pot culture phase (after 21 weeks under pot culture conditions), in terms of Cu concentration (μg/gr dry weight) actual amount (Total Cu, mg/plant), percentage increase as related to start sample, and percentage destribution in different plant organs as related to the amount of whole plant at the end of pot culture stage, as affected by the combined treatments with IBA and BA.

IBA (ppm)	BA (ppm)	Cu concentration (mg/gr dry wt.) pot culture period							Total Cu (mg/plant) pot culture period							% increase as related to start sample		% increase at related to start sample		% destrilaution as related to whole plant (pot period)			
		start sample	W.C.	root	stem	l. petid	l blade	whole plant	start sample	W.C.	root	stem	l petid	l blade	whole plant	W.C.*	P.C.*	W.C.*	P.C.*	root	stem	l. petid	l blade
0.0	0	7.0	8.5	7.5	5.0	10.0	10.5	8.1	1.23	2.65	1.30	2.11	2.425	4.56	10.39	1.42	9.16	115.4	744.7	12.5	20.3	23.3	43.9
	5		12.0	5.5	2.5	12.5	7.0	6.3		3.28	1.20	1.14	2.62	3.62	8.58	2.05	7.35	166.7	597.6	14.0	13.3	30.5	43.2
	10		9.0	5.0	2.0	12.5	5.5	5.6		2.59	0.83	0.64	2.28	2.46	6.21	1.36	4.98	110.6	404.9	13.4	10.3	36.7	39.5
Mean			9.8	6.0	3.2	11.7	7.7	6.7		2.84	1.11	1.30	2.44	3.55	8.38	1.61	7.16	130.9	582.4	13.3	14.6	30.2	42.2
0.1	0		12.5	5.0	2.5	20.5	7.5	6.8		4.08	1.19	1.11	2.77	4.36	9.43	2.85	8.20	231.7	666.7	12.6	11.8	29.4	46.2
	5		12.5	10.0	5.0	15.0	10.5	7.9		3.86	2.16	1.78	3.44	4.54	9.76	2.63	8.53	263.0	693.5	18.1	14.9	28.9	38.1
	10		12.0	7.5	5.5	10.5	10.5	8.4		3.35	2.08	1.86	2.00	3.60	9.36	2.12	8.13	172.4	661.8	22.2	17.9	21.4	78.5
Mean			12.3	7.5	4.3	15.2	9.5	7.7		3.76	1.81	1.58	2.74	4.17	9.52	2.53	8.29	222.4	673.7	17.6	14.9	26.6	40.9
0.2	0		9.0	7.5	5.0	5.0	10.0	7.3		23.4	1.78	1.68	0.92	4.38	8.76	1.11	7.53	90.2	612.2	20.3	19.2	10.5	50.0
	5		11.0	2.5	5.0	5.0	10.0	6.3		2.83	0.58	19.91	0.98	4.41	7.88	1.60	6.65	130.1	540.7	7.4	24.2	12.4	56.0
	10		13.5	2.5	3.0	5.0	10.0	5.9		3.70	0.61	1.02	1.04	4.86	7.53	2.47	6.30	200.8	512.2	8.1	13.5	18.81	64.5
Mean			11.2	4.2	4.3	5.0	10.0	6.5		2.96	0.99	1.54	0.98	4.55	8.06	1.73	6.83	140.4	555.0	11.9	19.0	12.2	56.8
B A	0		10.0	6.7	4.2	12.5	14.2	7.4		3.02	1.42	1.63	2.04	4.43	9.53	1.79	8.30	145.8	674.5	15.1	17.1	21.1	46.7
	5		11.8	5.8	5.8	10.0	5.8	6.8		3.32	1.31	1.61	2.35	4.19	8.74	2.09	7.51	186.6	610.6	13.2	17.5	23.9	45.9
	10		11.5	5.0	5.0	4.2	5.0	6.6		3.21	1.17	1.17	1.77	3.64	7.70	1.98	6.47	161.3	526.0	14.6	13.9	24.0	47.5
Total mean			11.1	5.8	5.0	8.9	8.3	6.9		3.18	1.30	1.47	2.05	4.09	8.66	1.95	7.43	164.6	603.7	14.3	16.2	23.0	46.7

W.C end of water culture period J.P.C.: end of pot culture period.

Table (38): Combined effect of IBA and BA on the destribution proportion of macro and micro nutrients as related to every their total amounts per plant and the proportion of macro-to micro nutrients in *Scindapsus aureus* at the end of water culture period (35 days) and at the end of pot stage periods (21 weeks).

IBA (ppm)	BA (ppm)	After 35 days under water culture: Proportion of macro as % to total amount N	P	K	Ca	Mg	Proportion of macro as % to total amount Fe	Zn	Mn	Cu	proportion of macro to micro macro	micro	After 21 weeks under pot culture: Proportion of macro as % to total amount N	P	K	Ca	Mg	Proportion of macro as % to total amount Fe	Zn	Mn	Cu	proportion of macro to micro macro	micro
start sample		31.53	0.80	31.12	34.18	2.37	82.51	1.71	15.26	0.51	18.92	1.08												
0.0	0	26.44	1.90	31.26	37.79	2.61	78.14	1.46	19.60	0.79	99.00	1.00	23.9	1.73	40.19	33.17	1.00	30.56	11.53	56.80	1.12	99.30	0.70
	5	25.70	1.05	26.58	44.54	2.13	92.32	0.88	6.42	0.38	97.07	2.93	27.46	2.30	35.97	32.78	1.48	30.73	13.49	54.98	0.80	99.11	0.89
	10	29.56	0.99	24.19	43.14	2.11	76.77	2.78	19.47	0.97	99.14	0.86	21.34	1.40	46.91	29.23	1.13	29.78	16.43	53.12	0.67	99.26	0.74
Mean		27.23	1.31	27.34	41.82	2.28	82.41	1.71	15.16	0.71	98.40	1.60	24.24	1.81	41.02	31.73	1.20	30.36	13.82	54.97	0.86	99.22	0.78
0.1	0	28.54	1.10	26.92	41.18	2.25	77.25	2.65	19.10	1.0	98.99	1.01	24.3	2.21	39.44	32.73	1.25	28.22	12.47	48.49	0.82	99.19	0.81
	5	25.29	2.33	28.80	41.46	2.11	76.58	2.22	19.92	1.28	99.20	0.80	24.36	1.87	42.04	30.55	1.17	40.38	12.18	46.53	0.92	99.17	0.83
	10	30.56	1.13	27.93	37.61	2.77	79.97	2.75	16.0	1.28	99.14	0.86	24.13	1.93	45.79	27.12	1.03	44.13	12.60	42.24	1.04	99.22	0.79
Mean		28.13	1.52	27.88	40.08	2.38	77.93	2.54	18.34	1.19	99.11	0.89	24.28	2.00	42.42	30.13	1.15	40.91	12.42	45.75	0.93	99.19	0.81
0.2	0	30.55	1.33	25.82	40.08	2.23	79.11	3.24	16.75	0.90	99.12	0.88	25.97	1.86	44.60	27.00	0.57	43.04	12.04	43.98	0.95	99.21	0.79
	5	28.62	1.32	26.78	40.42	2.87	78.49	2.67	25.91	0.92	98.91	1.09	25.63	2.36	38.72	32.52	0.77	44.55	12.34	42.32	0.79	99.17	0.83
	10	31.67	0.84	27.44	37.72	2.32	67.92	2.46	28.42	1.21	98.96	1.04	26.07	2.29	40.84	29.87	0.93	42.96	16.50	39.77	0.78	99.24	0.76
Mean		30.28	1.16	26.68	39.41	2.47	72.51	2.79	23.69	1.01	99.0	1.00	25.89	2.17	41.39	29.80	0.76	43.52	13.63	42.02	0.84	99.21	0.79
0.2	0	28.51	1.44	28.00	39.68	2.36	78.17	2.45	18.48	0.90	99.04	0.96	24.75	1.93	41.41	30.97	0.94	37.27	12.01	49.76	0.96	99.23	0.77
	5	26.34	1.57	27.39	42.14	2.37	79.80	1.92	17.42	0.86	98.39	1.61	25.82	2.18	38.91	31.95	1.14	38.55	12.67	47.94	0.84	99.15	0.85
	10	30.60	0.99	26.52	39.49	2.40	74.89	2.66	21.30	1.15	99.08	0.92	23.85	1.87	44.51	28.74	1.03	38.96	15.18	45.04	0.83	99.24	0.76
Mean		28.55	1.33	27.30	40.44	2.38	77.62	2.34	19.07	0.97	98.85	1.16	24.81	1.99	41.61	30.55	1.04	38.26	13.29	47.58	0.88	99.21	0.79

riod. The proportion, of N seemed to be higher slightly than K at the end of water culture riod. This may be indicated that the absorption and the accumulation of both N and K emed to be nearly constant or at the same rate.

- As a general, the highest proportion of the micro nutrients is found in Fe, followed / Mn, Zn and finally Cu since Fe is more than 3/4 amounts of micro-elements, and Fe is)out four times of Mn during water culture periods.

- As a general, at the end of pot periods (21 weeks of re-trans plantis), the highest ortion of macro-nutrients is K followed by Ca, N, P and finally Mg. This indicates that *'cindapsus aureus* plants changed the ability to absorb the nutrients during solid culture hase than during water culture phase. On the other hand, the behaviour of ***Scindapsus ureus*** for the absorption and accumulation of the different nutrients was greatly changed luring the two phases of growth media, to serve the growth stages, as during water culture)hase the plant directed its effort to root initiation and its development, while during solid)hase (pot culture periods) the plant directed its effort to build out the root beside the shoot system. Accordingly, the absorption and accumulation of K exceeded greatly those of N in this type of semihydrophytic plant. In addition, less proportion of Ca absorption was noticed during solid phase culture as related to the corresponding ones of water culture phase.

- The proportion of Mn exceeded greetly the proportion of Fe during solid phase as compared to those corresponding ones of water culture phase. This again indicates that the requirment of Mn is higher than that of Fe in such semi-hydrophilic plant.

With regards to the effect of IBA on the ratio between the accumulated proportions of macro elements, it could be concluded that such growth regulator stimulated the accumulation proportions of N and decreased Ca proportion in ***Scindapsus aureas*** plant tissues. In other words, regulates the balance between N and Ca mainly, with irregular and small changes in other macro-nutrients, during water culture.

In addition, IBA declined Fe proportion and increased Mn, during water culture stage. Accordingly the regulatory effect of IBA during water culture phase on plant growth behaviour may be due to, partially, to its regulatory effect on the balance between N and Ca of macro-nutrients and Fe and Mn of micro-nutrients.

However, during solid phase very slight change in macro-nutrients proportion was ıserved, but great variation in Fe and Mn was concluded as the proportion of Fe was :creased and Mn increased. This great variance in the proportion of Fe and Mn may be lated partially to the change in absorption rate of both element and may play a partially in ıe control of plant growth behaviour during solid culture phase.

With regard to the effect of BA, on the balance between the proportion of macro- nd micro-nutrients, it may be concluded that 5 ppm seemed to have a stimulatory effect on ıe accumulation proportions of Ca and depressive effect on N and K of macro-nutrients. \t the same times BA at 5 ppm stimulated slightly Fe and had depressive effect on Zn, Mn ınd Cu during water culture phase. In addition, BA at 5 ppm changed greatly the balance of nacro and micro-nutrients during solid culture phase. BA at 10 ppm showed another :hanges in the balance of macro-and micro nutrients.

The combined effect of IBA and BA was greatly variable from one probable combination to another.

(R) Combined effect of IBA and BA on the concentration of chloroplast pigments in Scindapsus aureus leaves at the end of pot staege in terms of mg/gr. fresh weight or (mg/cm^2)

The shape of such variegated plant depends on the ratio between green and yellowish islands, and that plays an important role on photosynthesis activity. Accordingly, our study was extended to include the combined effect of IBA and BA on chlorophylls "a" and "b", carotenoids, ratio of chlorophyll "a/b", and the ratio of total chlorophylls / carotenoids. In this type of foliage decorative plant, the colour of unit area may be changed greatly especially in ***Scindapsus aureus*** according to the changes in environmental factors. Accordingly, the calculation of chloroplast pigments was carried out either on fresh weight basis or on unit area (one cm^2) ***(Table, 39).***

The following conclusions may be stated as follows:

Table (39): Combined effect of IBA and BA or the concentration of choroplast bigments in terms of mg/gr fresh weight or mg/Cm² in *Scindapsus aureus* leaves at the end of pot stage (21 weeks after re-translanted).

IBA (ppm)	BA (ppm)	chloroplast bigments on fresh weight basis (mg/gr. fresh weight						Chloroplast bigments on unit area basis (mg/cm²)					
		chl.a	chl.s	chl.atb	chla/b	caro.	chlo atb/caro	chl.a	chlerob	chl.atb	caro.	chler. a/b	chlo. atb/caro
0.0	0	0.61	0.26	0.87	2.35	0.26	3.35	0.0159	0.0069	0.0228	0.0067	2.30	3.40
	5	0.68	0.29	0.97	2.34	0.28	3.46	0.0172	0.0073	0.0245	0.0070	2.36	3.50
	10	0.75	0.35	1.10	2.14	0.30	3.66	0.0172	0.0081	0.0253	0.0068	2.36	3.72
Mean		0.68	0.30	0.98	2.28	0.28	3.49	0.0168	0.0074	0.0242	0.0068	2.24	3.54
0.1	0	0.49	0.23	0.72	2.13	0.20	3.60	0.0122	0.0056	0.0178	0.0049	2.18	3.63
	5	0.63	0.28	0.91	2.25	0.25	3.64	0.0165	0.0073	0.0238	0.0065	2.26	3.66
	10	0.68	0.32	1.00	2.12	0.27	3.70	0.0172	0.0081	0.0253	0.0068	2.36	3.72
Mean		0.60	0.28	0.88	2.17	0.24	3.65	0.0153	0.0070	0.0223	0.0061	2.27	3.67
0.2	5	0.57	0.27	0.84	2.11	0.23	3.65	0.0135	0.0065	0.0200	0.0054	2.08	3.70
	5	0.67	0.30	0.97	2.23	0.27	3.59	0.0169	0.0075	0.0244	0.0067	2.25	3.64
	10	0.65	0.30	0.95	2.16	0.25	3.80	0.0162	0.0075	0.0237	0.0062	2.16	3.86
Mean		0.63	0.29	0.92	2.17	0.25	3.68	0.0155	0.0072	0.0227	0.0061	2.16	3.73
mean of B A													
0.2	0	0.56	0.25	0.81	2.20	0.23	3.53	0.0139	0.0063	0.0202	0.0057	2.19	3.58
	5	0.66	0.29	0.95	2.27	0.27	3.56	0.0169	0.0074	0.0242	0.0067	2.29	3.60
	10	0.69	0.32	1.02	2.14	0.27	3.72	0.0169	0.0079	0.0248	0.0066	2.29	3.77
Mean		0.64	0.29	0.93	2.20	0.26	3.60	0.0159	0.0072	0.0231	0.0063	2.26	3.65

(i) As a general and irrespective to other factors, IBA seemed to minimize different loroplast pigments as a concentration on fresh weight basis or on the basis of unit area, as ell as the ratio between chlorophylls a/b or the ratio of total chlorophyll/carotenoids.

(ii) At the same time the ***Vice versa*** was obtained by BA, as most criteria under BA eatments were higher over the control treated plants.

The above mentioned findings may be discussed on the basis that both types of rowth regulators seemed to have a direct or indirect role on the synthesis of chloroplast igmens.

(iii) The highest concentration of different pigments was obtained under the reatments with 10 ppm BA alone. The applications of IBA at the rate of 0.1 or 0.2 ppm. Vith 10 ppm. BA minimized the stimulatory effect of BA on chloroplast pigments.

L) Combined effect of IBA and BA on the concentration of some carbohydrate fractions in Scindapsus aureus at the end of water and pot culture phases (Table, 40):

As it was mentioned before IBA and BA and their probable combinations affected the concentration of photosynthetic pigments. Accordingly, the carbohydrate metabolism may be affected by the using of such treatments **(Table, 40).**

It may conclude the following conclusions:

- As a general, reducing sugars concentration exceeded the concentration of non-reducing ones. The polysaccarides concentrations exceeded the sugars content. This is a fact during water culture phase.

- The highest concentrations of reducing sugars was found in leaf blade followed by leaf petiol, stem and finally the root ranked the fourth. On the other hand, leaf petiol combrised the highest concentration of non reducing sugars followed by stem, leaf blade and finally root. At the same time, stem possessed the highest concentrations of poly saccharides followed by leaf blade, leaf petiole and finally root. Thus, the highest proportion of reducing and non reducing sugars in plant organs, serve as the main source of different metabolic activity processes beside their role in the cell turgidity of such semi-hydrophytic plant to stimulate the osmotic potential beside the metabolic activity processes. On the other hand, stem possessed the highest concentrations of poly-saccharides, as storage organs and

Table (40): Combined effect of IBA and BA on the concentration of carbohydrate fractions in terms of mg/gr, dry weight in ***Scindapsus aureus*** at the end of water and pot cultures periods (35 days and 21 weeks respectively).

IBA (ppm)	BA (ppm)	After 35 days under water culture					After 21 weeks under pot culture conditions, of different plant parts																			
							Root					Stem					leaf petiol					leaf blade				
		R.S.	N.R.S.	T.S.	H.C.	T.C.	R.S.	N.R.S.	T.S.	H.C.	T.C.	R.S.	N.R.S.	T.S.	H.C.	T.C.	R.S.	N.R.S.	T.S.	H.C.	T.C.	R.S.	N.R.S.	T.S.	H.C.	T.C.
Start Sample		32.8	35.5	68.3	97.1	165.4																				
0.0	0	23.6	36.8	60.4	97.1	157.5	36.9	42.0	78.8	152.2	231.0	44.6	34.2	78.8	354.2	433.0	49.8	81.5	131.3	147.0	278.3	36.8	47.2	84.0	189.0	273.0
	5	47.3	70.8	118.1	70.9	189.0	31.5	52.5	84.0	120.8	204.8	21.8	68.3	89.3	173.2	262.5	73.5	136.5	210.0	105.0	315.0	131.3	110.2	241.5	115.5	357.0
	10	47.3	76.1	123.4	107.6	231.0	49.9	97.1	147.0	89.3	236.3	63.0	42.0	105.0	236.3	341.3	78.8	68.2	147.0	52.5	199.5	73.5	189.0	262.5	131.3	393.8
Mean		39.4	61.2	100.6	91.9	192.5	39.4	63.9	103.3	120.8	224.0	42.9	48.2	91.0	254.6	345.6	67.4	95.4	162.8	101.5	264.3	80.5	115.5	196.0	145.3	341.3
0.1	0	55.1	31.5	86.6	97.2	183.8	52.5	78.8	131.3	52.5	183.8	94.5	131.3	225.8	199.2	425.0	36.8	131.2	168.0	118.3	278.3	105.0	120.8	225.8	63.8	288.8
	5	47.3	28.8	76.1	160.2	236.3	57.8	73.5	131.3	68.2	199.5	84.0	99.8	183.8	403.7	587.5	73.5	110.3	183.8	68.2	252.0	94.5	73.5	168.0	84.0	252.0
	10	63.0	28.9	91.9	115.5	207.4	60.4	18.4	78.8	120.7	199.5	60.4	175.9	236.3	199.5	435.8	36.8	120.7	157.5	105.0	262.5	84.0	89.3	173.3	57.7	231.0
Mean		55.1	29.7	84.9	124.3	209.2	56.9	56.9	113.8	80.5	194.3	79.6	135.7	215.3	267.5	482.8	49.0	120.7	169.8	94.5	264.3	94.5	94.5	189.0	68.2	357.3
0.2	0	28.9	34.1	63.0	147.0	210.0	44.6	112.9	157.5	68.3	225.8	81.4	86.6	168.0	336.0	504.0	84.0	63.0	147.0	73.50	220.5	94.5	73.5	168.0	84.0	252.0
	5	47.3	13.1	60.4	196.9	257.3	47.3	68.2	115.5	99.8	215.3	68.3	178.5	246.8	283.2	530.0	84.0	105.0	189.0	68.3	257.3	199.5	52.5	252.0	26.3	278.3
	10	42.0	31.5	73.5	241.5	315.0	73.5	73.5	147.0	42.0	189.0	120.8	47.2	168.0	315.0	483.0	173.3	63.0	236.3	105.0	341.3	183.8	57.7	241.5	105.0	346.5
Mean		39.4	26.2	65.6	195.1	260.8	55.1	84.9	140.0	70.0	210.0	90.2	104.1	194.3	311.4	505.7	113.8	77.0	190.8	82.3	273.0	159.3	61.2	220.5	71.8	292.3
mean of BA																										
BA	0	35.9	34.1	70.0	113.8	183.8	44.6	77.9	122.6	91.0	213.5	73.5	84.0	157.5	296.5	454.0	56.9	91.9	148.8	110.3	259.0	78.8	80.5	159.3	112.0	271.3
	5	47.3	37.6	84.9	142.7	227.5	45.5	64.7	110.3	96.3	206.5	57.8	113.5	171.3	286.7	460.0	77.0	117.3	194.3	80.5	274.8	141.8	78.7	220.5	75.3	295.8
	10	58.8	45.5	96.3	154.9	251.1	61.3	63.0	124.3	84.0	208.3	81.4	88.4	169.8	250.3	420.0	96.3	84.0	180.3	87.5	267.8	113.8	111.9	225.8	98.0	323.8
Mean		44.7	39.1	83.7	137.1	220.8	50.5	68.5	119.1	90.4	209.4	70.9	98.0	166.9	277.8	444.7	76.7	97.7	174.5	92.8	267.2	111.5	90.4	201.9	95.1	297.0

R. = Reducing, S.= Sugars ,N.= None , T = Total ,H = Hydrolizabol ,C.= Carbohydrate.

.t may help in the success of stem cuttings to rooting ability. The different carbohydrate ıctions in leaf blade and leaf petiole aid as storage organs for rooting ability of this type of ınts.

- It may conclude that great variation in the fraction of carbohydrate by using IBA, ٨ and their combinations and that affected and control plant growth behaviour during ıth water and solid culture phase.

ı) Combined effect of IBA and BA on amino acids content at the end of water culture ıase in scindapsus aureus plantlet:

As amino acids are the main structure of proteins and many other metabolic ɔmpounds which play an important role in building out the new formed cells, this study ·as extended into the picture of free, bound proteinous and total amino acids in ***cindapsus aureus*** at the end of water culture phase. These data are tabulated in Tables 41, 42, 43, 44) in the form of concentration as mg/gr dry weight.

(m, a) Free amino acids (Table, 41):

t may be concluded the following conclusions:

- The main domenant amino acidis serine + asparatic followed by leucine + soleucine, tyrosine, valine + methionine, thereonine, histidine + arginine, proline, alanine, glutamic, glycine, cysteine and finally phenylalanine - lysine being the lowest ones.

- Some amino acids concentrations in ***Scindapsus aureus*** decreased with the application of IBA while the other increased. Glycine, thereonine and glutamic decreased with IBA application, while alanine, serine + aspartic, phenylalanine, proline and lysine increased by IBA applications. Other amino acids increased or decreased under the rate of 0.1 ppm IBA. The concentration of valine + methionine and tyrosine increased sharply when IBA was applied at the rate of 0.1 ppm but such acids decreased when IBA was applied at 0.2 ppm.

- With regards to the effect of BA, irrespective to other factors, it could be stated that most of amino acids increased under 5 ppm. BA, while 10 ppm. BA decreased such free amino acids.

Table (41): Combined effect of IBA and BA on the concentration of free amino acids (mg/gr, dry weight) at the end of water culture periods (35 days of incabation) *Scindapsus aureus* plantlet.

IBA	BA	Glycine	Threonine	Alanine	Serine Asparti	Valine+ methionina	Leucine +Isoleucine	Phenylalanine	Tyrosine	Cysteine	Proline	Glutamic	Histidine+Arginine	Lysine	Total
start sample		0.07	0.26	0.35	0.35	0.43	0.32	0.15	0.39	0.07	0.14	0.22	0.22	0.17	3.14
0.0	0	0.24	0.39	0.17	0.17	0.35	0.43	0.00	0.30	0.09	0.00	0.13	0.26	0.07	2.60
	5	0.20	0.28	0.00	0.39	0.37	0.35	0.07	0.41	0.17	0.21	0.26	0.17	0.00	2.88
	10	0.20	0.30	0.15	0.47	0.20	0.30	0.04	0.35	0.06	0.21	0.28	0.30	0.06	2.92
Mean		0.21	0.32	0.11	0.34	0.31	0.36	0.04	0.35	0.11	0.14	0.22	0.24	0.04	2.80
0.1	0	0.00	0.20	0.00	0.34	0.30	0.45	0.17	0.37	0.11	0.00	0.00	0.20	0.09	2.23
	5	0.17	0.28	0.22	0.32	0.45	0.43	0.15	0.37	0.13	0.36	0.22	0.22	0.11	3.43
	10	0.11	0.41	0.26	0.41	0.39	0.43	0.15	0.37	0.09	0.14	0.30	0.24	0.00	3.30
Mean		0.09	0.30	0.16	0.36	0.38	0.44	0.16	0.37	0.11	0.17	0.17	0.22	0.07	2.99
0.2	0	0.15	0.24	0.17	0.48	0.26	0.34	0.11	0.33	0.09	0.29	0.17	0.32	0.13	3.08
	5	0.17	0.30	0.31	0.45	0.30	0.22	0.07	0.35	0.11	0.07	0.15	0.20	0.22	2.92
	10	0.00	0.22	0.26	0.35	0.30	0.41	0.02	0.22	0.17	0.36	0.00	0.28	0.11	2.70
Mean		0.11	0.25	0.25	0.43	0.29	0.32	0.07	0.30	0.12	0.24	0.11	0.27	0.15	2.90

0.2	0	0.13	0.28	0.11	0.33	0.30	0.41	0.09	0.33	0.10	0.10	0.10	0.26	0.10	2.64
	5	0.18	0.29	0.18	0.39	0.37	0.33	0.10	0.38	0.14	0.21	0.21	0.20	0.11	3.08
	10	0.10	0.31	0.22	0.41	0.30	0.38	0.07	0.31	0.11	0.24	0.19	0.27	0.06	2.97
Mean		0.14	0.29	0.17	0.38	0.32	0.37	0.09	0.34	0.12	0.18	0.17	0.24	0.09	2.90

- It could be stated also that total amino acids increased gradually under the atment with 0.0 ppm. IBA plus 0.0, 5 or 10 ppm BA, while under 0.1 ppm IBA higher ıount of total free amino acids by using 5 or 10 ppm BA, but vice versa was true when A used at the rate of 0.2 ppm.

ı, b) Proteinious amino acids (Table, 42):

may be concluded the following conclusions:

- The picture of proteinious amino aicds showed that leucine + isoleucine + ıenylalanine are the dominant amino acids in ***Scindapsus aureus*** tissues, as a general and respective to other treatments followed by Glycine, threonine, alanine, valine + ıethionine, proline, glutamic, histidine + arginine, tyrosine, serine + aspartic, cysteine and nally lysine are arranged in a discending order.

- It could be stated that the treatments with IBA, BA and their probabol ombinations affected greatly the bound amino acids in ***Scindapsus aureus***, as irregular hanges was obtained in this respect. Accordingly, it was concluded that many changes in ›ound amino acids were obtained by the applications of the tested growth regulators.

'm, c) Total amino acids (bound and free) (Table, 43):

:t could be stated that total amino acids, bound plus free, showed the same trend of both tested fractions of amino acids.

Table (44) showed the proportion distributions of every amino acids as related to the total amino acids. These data indicate that great changes occurred by using the different treatments. Again, great troublesome in the accumulation of different fractions of amino acids in ***Scindapsus aureus*** as related to the different treatments with growth regulators under the conditions of this experiment.

The various available results of this experiment indicate that it is possible to improve the rooting ability of ***Scindapsus aureus*** single node leafy soft stem cuttings by using one of the most popular synthetic auxin, IBA (indolebuteric acid) alone at very low rates, i.e. 0.1 or 0.2 ppm (100 or 200 ppb). The effect of such substance at different tested rates under the conditions of this experiment, as well as BA (benzyladenine) and their probable combinations on rooting ability were extended to all tested growth behaviour; either during

Table (42): Combined effect of IBA and BA on the concentration of bound proteivous amino acids (mg/gr, dry weight) at the end of water culture periods (35 days of incabation) in *Scindapsus aureus* plantlet.

IBA (PPm)	BA (PPm)	Glycine	Threonine	Alanine	Serine+ Aspartic	Valine+ methionine	Leucine+ Isoleucine+ phenylanine	Tyrosine	Cysteine	Proline	Glutamic	Histidine+ Arginine	Lysine	Total
start sample		9.87	11.54	11.14	2.75	8.89	18.78	3.34	1.17	5.81	6.61	4.44	0.45	84.79
0.0	0	13.74	15.14	14.12	4.49	13.31	28.14	5.29	1.77	9.52	11.05	4.40	1.48	122.45
	5	11.29	12.76	11.18	3.34	10.50	18.87	3.94	1.69	6.93	7.50	3.25	1.24	92.49
	10	13.15	9.02	8.55	3.26	5.39	10.84	2.76	0.87	2.17	1.89	2.18	0.00	60.08
Mean		12.73	12.31	11.28	3.70	9.73	19.28	4.00	1.44	6.21	6.81	3.28	0.91	91.67
0.1	0	16.77	12.22	12.11	2.77	7.15	14.29	3.36	1.13	3.57	2.80	4.77	0.22	81.16
	5	16.60	12.45	10.96	3.72	8.87	13.71	5.22	2.35	5.59	4.44	4.13	1.44	89.48
	10	12.31	10.46	8.44	2.39	5.51	10.60	2.74	1.77	3.43	4.67	3.49	0.93	66.74
Mean		15.23	11.71	10.50	2.96	7.18	12.86	3.77	1.75	4.20	3.97	4.13	0.86	79.13
0.2	0	16.35	13.11	11.63	3.56	6.57	14.46	3.40	2.71	3.28	6.66	4.96	1.11	87.80
	5	16.60	15.85	13.35	5.14	11.50	23.93	6.17	2.69	11.83	6.37	6.63	1.02	121.08
	10	17.39	14.38	11.54	4.00	9.64	21.93	5.06	2.94	7.97	3.11	4.69	1.44	104.09
Mean		16.78	14.45	12.17	4.23	9.24	20.11	4.88	2.78	7.69	5.38	5.43	1.19	104.32
BA	0	15.62	13.49	12.62	3.61	9.01	18.96	4.02	1.87	5.46	6.84	4.71	0.94	97.14
	5	14.83	13.69	11.83	4.07	10.29	18.84	5.11	2.24	8.12	6.10	4.67	1.23	101.02
	10	14.28	11.29	9.51	3.22	6.85	14.46	3.52	1.86	4.52	3.22	3.45	0.79	76.97
Mean		14.91	12.82	11.32	3.63	8.72	17.42	4.22	1.99	6.03	5.39	4.28	0.99	91.71

Table (43): Combined effect of IBA and BA on the concentration of total amino acids (mg/gr, dry weight) free and bound ones) at the end of water culture periods (35 days of incubation) in *Scindapsus aureus* plantlet.

IBA (PPM)	BA (PPM)	Glycine	Threonine	Alanine	Serine+ Aspartic	Valine+ methionine	Leucine+ Isoleucine+ phenylalnin	Tyrosine	Cysteine	Proline	Glutamic	Histidine+ Arginine	Lysine	Total
start sample		9.44	11.80	11.49	3.10	9.32	19.25	3.73	1.24	5.95	6.83	4.66	0.62	87.93
0.0	0	13.98	15.53	14.29	4.66	13.66	28.57	5.59	1.86	9.52	11.18	4.66	1.55	125.05
	5	11.49	13.04	11.18	3.73	10.87	19.29	4.35	1.86	7.14	7.76	3.42	1.24	95.37
	10	13.35	9.32	8.70	3.73	5.59	11.18	3.11	0.93	2.38	2.17	2.48	0.06	63.00
Mean		12.94	12.63	11.39	4.04	10.04	19.68	4.35	1.55	6.35	7.04	3.52	0.95	94.47
0.1	0	16.77	12.42	12.11	3.11	7.45	14.91	3.73	1.24	3.57	2.80	4.97	0.31	83.39
	5	16.77	12.73	11.18	4.04	9.32	14.29	5.59	2.48	5.95	4.66	4.35	1.55	92.91
	10	12.42	10.87	8.70	2.80	5.90	11.18	3.11	1.86	3.57	4.97	3.73	0.93	70.04
Mean		15.32	12.01	10.66	3.32	7.56	13.46	4.14	1.76	4.36	4.14	4.35	0.93	82.11
0.2	0	16.50	13.35	11.80	4.04	6.83	14.91	3.73	2.80	3.57	6.83	5.28	1.24	90.88
	5	16.77	16.15	13.66	5.59	11.80	24.22	6.52	2.80	11.90	6.52	6.83	1.24	124.00
	10	17.39	14.60	11.80	4.35	9.94	22.36	5.28	3.11	8.33	3.11	4.97	1.55	106.79
Mean		16.89	14.70	12.42	4.66	9.52	20.50	5.18	2.90	7.93	5.49	5.69	1.34	107.22

0.2	0	15.75	13.77	12.73	3.94	9.31	19.46	4.35	1.97	5.55	6.94	4.97	1.03	99.77
	5	15.01	13.97	12.01	4.45	10.66	19.27	5.49	2.38	8.33	6.31	4.87	1.34	104.09
	10	14.39	11.60	9.73	3.63	7.14	14.91	3.83	1.97	4.76	3.42	3.73	0.85	79.94
Mean		15.05	13.11	11.49	4.01	9.04	17.88	4.56	2.11	6.21	5.56	4.52	1.07	94.60

Table (44): Combined effect of IBA and BA on the proportion of individual total amino acids (bound and free ones) as related to total amount at the end of water culture periods of *Scindapsus aureus*.

IBA (PPm)	BA (PPm)	Glycine	Threonine	Alanine	Serine Asparti	Valine mathiam	Leucine+ Isolecuine+pheny-lalanine	Tyrosine	Cysteine	Proline	Glutamic	Histidine+Arginine	Lysine
start sample		11.30	13.42	13.07	3.53	10.60	21.89	4.24	1.41	6.77	7.77	5.30	0.71
0.0	0	11.18	12.42	11.43	3.72	10.92	22.85	4.47	1.49	7.61	8.94	3.73	1.23
	5	12.05	13.67	11.72	3.91	11.40	20.23	4.56	1.95	7.49	8.14	3.59	1.30
	10	21.19	14.79	13.81	5.92	8.87	17.75	4.94	1.48	3.78	3.44	3.94	0.10
Mean		14.81	13.63	12.32	4.52	10.40	20.28	4.66	1.64	6.29	6.84	3.75	0.88
0.1	0	20.11	14.89	14.52	3.73	8.93	17.88	4.47	1.49	4.28	3.36	5.96	0.37
	5	18.05	13.70	12.03	4.35	10.03	15.38	6.02	2.67	6.40	5.02	4.68	1.67
	10	17.73	15.52	12.42	4.00	8.42	15.96	4.44	2.66	5.10	7.10	5.33	1.33
Mean		18.63	14.70	12.99	4.03	9.13	16.41	4.98	2.27	5.26	5.16	5.32	1.12
0.2	0	18.16	14.69	12.98	4.45	7.52	16.41	4.10	3.08	3.93	7.51	5.81	1.36
	5	13.52	13.02	11.02	4.51	9.52	19.53	5.26	2.26	9.60	5.26	5.51	1.00
	10	16.28	13.67	11.05	4.07	9.31	20.94	4.94	2.91	7.80	2.91	4.65	1.45
Mean		15.99	13.79	11.68	4.34	8.78	18.96	4.77	2.75	7.11	5.23	5.32	1.27
BA	0	16.48	14.00	12.98	3.97	9.12	19.05	4.35	2.02	5.27	6.60	5.17	0.99
	5	14.54	13.46	11.59	4.26	10.32	18.38	5.28	2.29	7.83	6.14	4.59	1.32
	10	18.40	14.66	12.43	4.66	8.87	18.22	4.77	2.35	5.56	4.48	4.64	0.96
Mean		16.47	14.04	12.33	4.30	9.44	18.55	4.80	2.22	6.22	5.74	4.80	1.09

ter culture phase or during solid culture one (pot phase). The decorated shape was ınged completely as the morphological structure was controlled (plant length, number of w formed leaves, leaf area, total plant leaf area, internode lengthe ..... etc), by the tested atmants, This could be discussed on the basis that the tested growth regulators affected ; root initiation and its development which lead to the control of water and nutrients take and the latter lead also into great variations in plant metabolism such as rbohydrate and amino acids, free or bounded ones, as shown in the results of this :periment.

Now their is no doubt that auxins either endogenous or exogenous ones play an ıportant role in the rooting abilty and the success of the numbers of pant species as :ported by a lot of workers since 1935 till now (see the review of literature). However, ıeir are many arguments between the workers in the field of the proper auxin substances NAA, IAA, IBA or 2, 4-D.... etc), their concentrations, the time of application, the plant ıaterial, plant species, the condition and the physiological stage of plant material, the esponsibility of the tested plant species it self to the application, the media and the ıevailing condition prior and after the treatment, the method of application and finally the ıther endogenous and exogenous co-factors such as carbohydrate levels and the balance ıetween the growth regulators especially cytokinins. These are few in the feild of the, complecated physiological phenomenu such as rooting ability by the cuttings of plants, which have been tested by the workers till now.

In this study very low rate of IBA improved the success of ***Scindapsus aureus*** cuttings, as these plant cuttings are very sensitive to the application of relatively high rates as shown in the preliminary experiments. In addition, the role of auxins in promoting root is not yet solved till now.

Again, it is now accepted and has been subsequently confirmed many times that auxin application, is the requirement for initiation of adventitious roots on stem and indeed it has been shown that the division of the first root initial cells are depended upon either applied or endogenous auxins. It was found by many workers that IBA is one of the most active auxin in promoting adventitious root formation of cuttings (among those workers

, Wilkins 1969, Devlin, 1975, Geneve & Heuser, 1982 and Devlin & Witham, 83).

According to the available literature, it was found that auxins are not the only omoting factor, but there are many factors play an important role in the regulation of ventitious root formation in the cuttings (amonge those workers, are, **Tyce, 1957; Hess, 64; Chin, *et al.*, 1969; Iwasaki & Weaver, 1977 and Devlin & Witham, 1983).** Root ferentiation was controlled, in part, by the balance between either growth inhibitor and omoting substances or between auxins and cytokinins. However, under the conditions of ir experiment the balance between IBA and BA application was in the proportion of tokinins and that minimized the stimulatory effects of auxins in rooting ability of ***cindapsus aureus***. In this conmection, **Torrey (1956) and Heide (1965)** concluded that gh proportions auxins and low concentration proportions of cytokinins stimulate root itiation. In addition, the levels of carbohydrates, and phenolic compouds in the plant aterial may be related to the activity of tissues and the formation of adventitious roots **Stoltz, & Hess, 1966; Basu, *et al.*, 1969; Lipechi & Selwa, 1978 and many other Verkers).**

It was found under this experiment conditions that the application of synthetic uxins, IBA at very low rates increased rooting ability of ***Scinelapsus aureus,*** but only vhen the levels of the other root promoting factors were optimum in the cuttings. These esults are agreed with those reported by many workers amony them **(Haissing, 1972 and Tognoni, *et al.*, 1977).** It must be mentioned here that the induction of adventitious roots are generally governed by the complex interactions of several external and internal factors. Using a large possible of many growth regulators applications affected greatly the general metabolic activity and the uptake of nutrient and that given considerable possible and assunption information on the intrenal factors controlling root formation in the cuttings.

From this detail study it was supposed that application of IBA (auxin) and BA (cytokinin) troubled the uptake and the accumlation of the tested nutrients, the metabolic activity of carbohydrate, photosynthetic pigments, and amino acids thynthesis in ***Scindapsus aureus*** cuttings and that may play an important role in controlling its the rooting ability.

ɜ parcentage distribution changes of nutrients, carbohydrate fractions, and amino acids all y interpret with the success of ***Scindapsus aureus*** cuttings.

However, in spite of the above mentioned information, the mode of action of the ɜd growth regulators is still unkown and it was proposed that our study must be extended get more information about the role of the tested substances.

ɪperiment III B.b

ɔmbined Effect of IBA, BA and GA_3 on The success of Sindapsus aureus Cuttings:

Although relatively few studies have been made on cytokinin effects on the root stem, cytokinins appear to be able both to stimulate and to inhibit root initiation and ɜvelopment **(Devlin & Withan, 1983).** In addition, there were many arguments between ıe workers in this respect as they observed variable results by using cytokinins on many lant materials **(see Skoog & Miller, 1957; Fries, 1960; Torrey, 1962 and Bonnett & 'orrey, 1965).**

In addition very little is known about the interaction effect of auxins and cytokinins ɔn root initiation and development. It was used relatively higher proportion ratio of ɔytokinin as related to auxins in the previous experiment (0.1 or 0.2 ppm. IBA: to 5.0 or 10 ɔpm of IBA. As it was found in the previous experiment the stimulatory effect of IBA on ·ooting ability of ***Scindapsus aureus*** cutting was controlled by the applications of BA and that was associated with great variable effects on many physiological processes. It must be mentioned that the obtained results depend on the balance between growth hormones which is influenced by the levels of endogenous hormones already present in the tested plant materials.

According to the forementioned information, this study was extended to show the effect of IBA at the rate of 0.2 ppm with combinations of 0.2 ppm. BA and 5 ppm. GA_3 applied alone or in the probable combinations on rooting ability of ***Scindapsus aureus*** cuttings.

nbined effect of IBA, BA and GA_3 on rooting ability of Scindapsus aureus cuttings ble, 45).

The following conclusions may be observed:

- IBA irrespective to other treatments at the rate of 0.2 ppm. stimulated higher centage of rooted cuttings durng different periods of water culture incubation which ended to 28 days. On the other hand, BA at the rate of 0.2 ppm seemed to have very le effect in this respect, while GA_3 at the rate of 5 ppm. declined greatly the rooting ility of ***Scindapsus aureus*** during different periods of incubution.

- The best results was obtained by the application of IBA in the presence of BA, th applied at 0.2 ppm. in the absence of GA_3

- GA_3 seemed to retard the stimulatory effect of IBA * BA.

Again, it must be mentioned that the combined effect was controlled by the oportion ratio of the three promoting substances, IBA, BA and GA_3

ombined effect of IBA, BA and GA_3 on the number of roots per one cutting of cindapsus aureus (Table, 46).

On statistical basis and irrespective to other treatments, IBA stimulated slightly root nitiation on ***Scindapsus aureus***, while BA seemed to decline slight the number of roots ormation, but GA_3 decreased relatively such formation.

The highest root number formation in ***Scindapsus aureus*** cuttings was gained when IBA applied at the rate of 0.2 ppm in the presence of 0.2 ppm BA without GA_3, the lowest value was gained in the absence of IBA and the presence of BA and GA_3.

Again the balance between the promoting growth regulators affected the root initiation number in ***Scindapsus aureus***.

Combined effect of IBA, BA and GA_3 on the rate of fresh weight percentage as related to start sample of Scindapsus aureus (Table, 47)

The development of fresh weight was increased with the advancing age under water culture periods. However, this increment was quite differed according to the applied growth

Table(45): Combined effect of IBA, BA and GA_3 on the number of roots per % of rooted cuttings of ***Scindapsus aureus*** during the periods of water culture phase.

Substance (ppm)			Days under water culture incubation			
IBA	BA	GA3	7	14	21	28
0.0	0.0	0.0	54.2	58.3	75.0	79.2
		5	54.2	62.5	62.5	62.5
	Mean		54.2	60.4	68.8	70.9
	0.2	0.0	70.8	70.8	79.2	95.8
		5	33.3	37.5	50.0	55.5
	Mean		52.1	54.2	64.6	75.7
Mean			53.2	57.3	66.7	73.3
0.2	0.0	0.0	62.5	72.7	75.0	83.3
		5	58.8	66.7	80.6	84.1
	Mean		60.7	69.7	77.8	83.7
	0.2	0.0	87.5	91.7	100.0	100.0
		5	37.5	41.7	53.0	53.0
	Mean		62.5	66.7	76.5	76.5
Mean			61.6	68.2	77.2	80.1
Total mean			57.4	62.8	72.0	76.7

Mean of BA

BA	0.0	57.5	65.1	73.3	77.3
BA	0.2	57.3	60.5	70.6	76.1

Mean of GA3

GA3	0.0	68.8	73.4	82.3	89.6
GA3	5	46.0	52.1	61.5	63.8

L.S.D. 5% between					
IBA (I)	0.1	0.1	0.2	0.2
BA (B)	0.1	0.1	0.2	0.2
GA3 (G)	0.1	0.1	0.2	0.2
I*B	0.2	0.2	0.2	0.2
I*G	0.2	0.2	0.2	0.2
B*G	0.2	0.2	0.3	0.3

)le(46): Combined effect of IBA, BA and GA_3 on the number of roots per one cutting of *Scindapsus aureus* during the periods of water culture phase.

Substance (ppm)			Days under water culture incubation			
IBA	BA	GA3	7	14	21	28
0.0	0.0	0.0	0.7	1.1	1.5	2.6
		5	0.9	1.1	1.3	2.5
	Mean		0.8	1.1	1.4	2.6
	0.2	0.0	0.8	0.9	1.5	2.7
		5	0.4	0.6	0.7	1.9
	Mean		0.6	0.8	1.1	2.3
Mean			0.7	1.0	1.3	2.5
0.2	0.0	0.0	0.7	1.3	2.5	3.1
		5	0.7	0.8	1.2	2.4
	Mean		0.7	1.1	1.9	2.8
	0.2	0.0	1.2	1.6	2.4	3.6
		5	0.4	0.8	0.8	2.1
	Mean		0.8	1.2	1.6	2.9
Mean			0.8	1.2	1.8	2.9
Total mean			0.8	1.0	1.6	2.7

BA	0.0	0.8	1.1	1.7	2.7
BA	0.2	0.7	1.0	1.4	2.6

GA3	0.0	0.9	1.2	2.0	3.0
GA3	5	0.6	0.8	1.0	2.2

L.S.D. 5% between:					
	IBA	0.01	0.01	0.01	0.02
	BA	0.01	0.01	0.01	0.02
	GA3	0.01	0.01	0.01	0.02
	I*B	0.01	0.01	0.02	0.02
	I*G	0.01	0.01	0.02	0.03
	B*G	0.01	0.01	0.02	0.03
	I*B*G	0.10	0.10	0.10	0.20

Table(47): Combined effect of IBA, BA and GA_3 on the rate of fresh weight percentage as related to start sample of *Scindapsus aureas* during the periods of water culture phase.

Substance (ppm)			Days under water culture phase			
IBA	BA	GA3	7	14	21	28
0.0	0.0	0.0	11.8	30.3	26.1	37.0
		5	10.1	12.1	17.1	23.1
	Mean		11.0	16.2	21.6	30.1
	0.2	0.0	10.1	14.1	22.8	28.7
		5	9.5	10.5	13.9	15.3
	Mean		9.8	12.3	18.4	22.0
Mean			10.4	14.3	20.0	26.1
0.2	0.0	0.0	12.0	14.9	18.6	26.8
		5	10.3	13.5	15.7	22.9
	Mean		11.2	14.2	17.2	24.9
	0.2	0.0	10.7	13.9	16.3	20.7
		5	10.9	12.6	15.0	17.6
	Mean		10.8	13.3	15.7	19.2
Mean			11.0	13.8	16.5	22.1
Total mean			10.7	14.1	18.3	24.1

Mean of BA

BA	0.0	11.1	15.2	19.4	27.5
BA	0.2	10.3	12.8	17.1	20.6

Mean of GA3

GA3	0.0	11.2	15.8	21.0	28.3
GA3	5	10.2	12.2	15.4	19.7

L.S.D. 5% between:				
IBA	0.1	0.2	0.2	0.2
BA	0.1	0.2	0.2	0.2
GA3	0.1	0.2	0.2	0.2
I*B	0.2	0.2	0.3	0.3
I*G	0.2	0.3	0.3	0.3
B*G	0.2	0.3	0.3	0.3
I*B*G	0.4	0.4	0.3	0.4

;ulators. IBA, BA and GA_3 retarded the progressive increase in fresh weight proportions related to the start sample under the level of control (0.0 ppm of both), as the highest ›portions of fresh weight was gained in the complete absence of any growth regulators, ıile the lowest values were gained by the application of 0.0, 0.2 and 5.0 ppm. of IBA, BA d GA_3 respectively.

›mbined effect of IBA, BA and GA_3 on dry matter percentage as related to start sample 'Scindapsus aureus (Table, 48)

As in fresh weight increase percentage as related to start sample, dry matter oportion increased progressively with advancing age. However, the used growth gulators seemed to have a stimulatory effect on dry matter proportion accumulation as lated to start sample over the control. The highest value in this respect was gained by the eatments with 0.0, 0.2 and 5 ppm of IBA, BA and GA_3 respectively. In other werds, GA_3 5 ppm seemed to have a synergetic effect of BA in dry matter accumulation in the eveloping ***Scindapsus aureus*** cuttings during the water culture incubation. In addition 3A has a small retardation effects in this respect. In other words, IBA retarded slightly the timulatory effect of BA in this respect.

Combined effect of IBA, BA and GA_3 on Scindapsus aureus plant length during lifferent periods of growth under pot conditions (Table, 49)

It must be mentioned that this study, as in the previous experiment was extended ınder solid phase of pot conditions to get some information about stem length and number of leaves per plant which define the decorated shape of such ornamental plant. This study was extended till the plants reached 147 days from re-transplanting the successful cuttings.

- As a general, progressive increase in plant length with advancing age.
- BA and GA_3 irrespective to other treatment retarded stem enlargement of ***Scindapsus aureus*** under the control ones. However, IBA showed a slight stimulatory effect in this respect. This is true during different periods of growth.

Table(48): Combined effect of IBA, BA and GA_3 on the dry weight percentage as related to start sample of *Scindapsus aureus* during the periods of water culture phase.

Substance (ppm)			Days under water culture phase			
IBA	BA	GA3	7	14	21	28
0.0	0.0	0.0	4.2	11.8	17.0	27.4
		5	17.2	19.3	24.6	31.1
	Mean		10.7	15.6	20.8	29.3
	0.2	0.0	8.7	12.6	20.8	26.7
		5	25.0	26.1	30.1	31.6
	Mean		16.9	20.9	25.5	29.2
Mean			13.8	18.3	23.2	29.3
0.2	0.0	0.0	9.7	12.7	16.5	24.6
		5	10.1	12.3	13.3	20.0
	Mean		9.9	12.5	14.9	22.3
	0.2	0.0	17.4	20.6	23.2	27.9
		5	21.3	23.2	25.8	28.8
	Mean		19.4	21.9	24.5	28.4
Mean			14.7	17.2	19.7	25.4
Total mean			14.3	17.8	21.5	27.4

Mean of BA

BA	0.0	10.3	14.1	17.9	25.8
BA	0.2	18.2	21.4	25.0	28.8

Mean of GA3

GA3	0.0	10.0	14.4	19.4	26.7
GA3	5	18.4	20.2	23.5	27.9

L.S.D. 5% between:	IBA	0.1	0.2	0.2	0.3
	BA	0.1	0.2	0.2	0.3
	GA3	0.1	0.2	0.2	0.3
	I*B	0.2	0.3	0.3	0.3
	I*G	0.2	0.3	0.3	0.3
	B*G	0.2	0.3	0.3	0.3
	I*B*G	0.3	0.4	0.4	0.4

Table(49): Combined effect of IBA, BA and GA_3 on *Scindapsus aureus* plant length during different periods of growth under pot conditions (cm.).

Substance (ppm)			Days after re-transplanting						
IBA	BA	GA3	21	42	63	84	105	126	147
0.0	0.0	0.0	1.7	2.4	4.2	5.6	7.2	9,3	12.5
		5	0.5	1.0	2.2	3.5	4.9	6,3	10.5
	Mean		1.1	1.7	3.2	4.6	6.1	7.8	11.5
	0.2	0.0	0.6	2.0	3.8	5.0	6.4	10,9	15.8
		5	0.6	1.0	2.1	3.4	4.6	6,8	10.8
	Mean		0.6	1.5	3.0	4.2	5.5	8,9	13.3
Mean			0.9	1.6	3.1	4.4	5.8	8.4	12.4
0.2	0.0	0.0	1.9	2.9	5.3	7.6	9.1	13.4	19.3
		5	0.8	1.0	2.1	3.2	4.4	7,7	13.7
	Mean		1.4	2.0	3.7	5.4	6.8	10,6	16.5
	0.2	0.0	0.9	1.6	3.2	4.7	6.1	10.4	14.4
		5	0.5	0.6	2.0	3.2	4.9	6.9	10.6
	Mean		0.7	1.1	2.6	4.0	5.5	8.7	12.5
Mean			1.1	1.6	3.2	4.7	6.2	9.7	14.5
Total mean			1.0	1.6	3.2	4.6	6.0	9.1	13.5

Mean of BA

BA	0.0	1.3	2.2	4.1	5.7	7.2	11.0	15.5
BA	0.2	0.6	0.9	2.1	3.3	4.7	6.9	11.4

Mean of GA3

GA3	0.0	1.3	1.9	3.5	5.0	6.5	9.2	14.0
GA3	5	0.7	1.3	2.8	4.1	5.5	8.8	12.9

L.S.D.5%:between: IBA	0.2	0.3	0.3	0.3	0.4	0.4	0.5
BA	0.2	0.3	0.3	0.3	0.4	0.4	0.5
GA3	0.2	0.3	0.3	0.3	0.4	0.4	0.5
I*B	0.4	0.4	0.4	0.4	0.5	0.5	0.6
I*G	0.4	0.4	0.4	0.4	0.5	0.5	0.6
B*G	0.4	0.4	0.4	0.4	0.5	0.5	0.6
I*B*G	0.5	0.5	0.5	0.5	0.6	0.6	0.7

The highest plant length was gained when IBA was applied at the rate of 0.2 ppm. in absence of BA and GA_3 as both later two growth regulators minimized the stimulatory ect of IBA.

mbined effect of IBA, BA and GA_3 on number of new formed leaves per plant during ferent periods of growth under pot conditions (Table, 50)

It could be concluded that BA and GA_3 declined slightly the leaf formation, while A stimulated such formation, irrespective to other treatments. The highest leaf formation as gained under IBA at the rate of 0.2 ppm. under the complete absence of BA or GA_3. At e same time the lowest value was obtained under the treatments with 0.2 + 0.2 + 5 ppm. IBA, BA and GA_3 respectively. This indicates that BA and GA_3 seemed to have a epressive effect on the enhancing effect of IBA on leaf formation.

Again, the balance between the applied growth regulators is very importance for the ontrol of plant growth behaviour. This conclusion was achieved by **Devlin & Witham 1983)** and many other workers, see the review of literature. On other words, the combined ffect of BA and/or GA_3 seemed to be, partially, adversed the effect of IBA.

Combined effect of IBA, BA and GA_3 on the accumulation of some nutrients in Scindapsus aureus plant tissues after 28 days of incubation under water culture conditions (Tables, 51 & 52)

The concentration of some macro-nutrients, N, P, K, Ca & Mg was tabulated in Table (51) while the concentration of some micro-nutrients, Fe, Mn, Zn and Cu was tabulated in Table (52).

It was concluded from these data the following conclusions:

The main dominant element in ***Scindapsus aureus*** rooted cuttings is mostly Ca followed by N, K, Mg while P is the fifth in this respect, while Fe is the main dominant micro-nutrient followed by Mn, Zn and Cu ranked the fourth in this respect.

Growth regulators troubeled the accumulations of the tested nutrients. In addition, as the best rooted cuttings percentage (100% rooted cuttings, was obtained by the application of 0.2 ppm. IBA + 0.2 ppm. BA in the absence of GA_3 (Table, 45). This

Table(50): Combined effect of IBA, BA and GA_3 on number of new formed leaves in *Scindapsus aureus* during different periods of growth under pot conditions.

Substance (ppm)			Days after re-transplanting						
IBA	BA	GA3	21	42	63	84	105	126	147
0.0	0.0	0.0	1.0	2.7	3.8	5.9	8.4	11.5	14.1
		5	0.0	1.1	2.1	3.9	7.5	8.1	11.2
	Mean		0.5	1.9	3.0	4.9	8.0	9.8	12.7
	0.2	0.0	0.5	2.2	3.6	5.9	8.9	12.8	15.3
		5	0.0	1.0	2.0	4.0	7.3	8.3	11.4
	Mean		0.3	1.6	2.8	5.0	8.1	10.6	13.4
Mean			0.4	1.8	2.9	5.0	8.1	10.2	13.1
0.2	0.0	0.0	1.9	3.9	4.8	7.9	10.4	13.5	17.8
		5	0.0	1.1	2.0	4.0	7.1	9.5	13.4
	Mean		1.0	2.5	3.4	6.0	8.8	11.5	15.6
	0.2	0.0	0.5	2.0	3.4	5.7	8.3	11.5	14.7
		5	0.0	1.0	2.0	3.9	6.6	9.7	11.2
	Mean		0.3	1.5	2.7	4.8	7.5	10.6	13.0
Mean			0.7	2.0	3.1	5.4	8.2	11.1	14.3
Total mean			0.6	1.9	3.0	5.2	8.2	10.7	13.7

Mean of BA

BA	0.0	0.8	2.2	3.2	5.5	8.4	10.7	14.2
BA	0.2	0.3	1.6	2.8	4.9	7.8	10.6	13.2

Mean of GA3

GA3	0.0	1.0	2.7	3.9	6.4	9.0	12.3	15.5
GA3	5	0.0	1.1	2.0	4.0	7.1	8.9	11.8

L.S.D.5%:between	IBA	0.1	0.1	0.1	0.2	0.2	0.3	0.3
	BA	0.1	0.1	0.1	0.2	0.2	0.3	0.3
	GA3	0.1	0.1	0.1	0.2	0.2	0.3	0.3
	I*B	0.1	0.2	0.2	0.3	0.3	0.4	0.5
	I*G	0.1	0.2	0.2	0.3	0.3	0.4	0.5
	B*G	0.1	0.2	0.2	0.3	0.3	0.4	0.5
	I*B*G	0.2	0.3	0.3	0.4	0.4	0.5	0.6

Table(51): Combined effect of IBA, BA and GA_3 on the concentration of some macro. nutrients in *Scindapsus aureus* plant tissues after 28 days of incubation under water culture conditions.

Substance (PPm)			Mg/grdry weight				
IBA	BA	GA3	N	P	K	Ca	Mg
0.0	0.0	0.0	37.8	1.915	31.1	35.0	3.013
		5	35.0	1.755	34.0	42.5	2.850
	Mean		36.4	1.875	32.6	38.8	2.932
	0.2	0.0	28.0	2.234	33.0	50.0	3.363
		5	32.9	1.995	34.4	55.0	3.650
	Mean		30.5	2.115	33.7	52.5	3.507
Mean			33.5	1.975	33.2	45.7	3.220
0.2	0.0	0.0	32.2	1.995	29.0	27.5	3.413
		5	33.6	1.755	29.5	32.5	3.663
	Mean		32.9	1.875	29.3	30.0	3.538
	0.2	0.0	32.2	1.436	24.9	35.0	3.450
		5	32.2	0.798	26.3	37.3	3.138
	Mean		32.2	1.117	25.6	36.2	3.294
Mean			32.9	1.496	29.4	33.1	3.416
Total mean			33.2	1.736	31.3	39.4	3.318

Mean of BA

BA	0.0	34.7	1.855	31.0	34.4	3.235
BA	0.2	31.4	1.616	29.7	44.4	3.401

Mean of GA3

GA3	0.0	32.6	1.895	29.5	36.9	3.310
GA3	5	33.4	1.576	31.1	41.8	3.325

Table(52): Combined effect of IBA, BA and GA_3 on the concentration of some micro. nutrients in *Scindapsus aureus* plant tissues after 28 days of incubation under water culture conditions

Substance (PPm)			Mg/gr dry weight			
IBA	BA	GA3	Fe	Mn	Zn	Cu
0.0	0.0	0.0	988.8	427.5	41.8	14.0
		5	851.3	410.0	27.5	15.0
	Mean		920.1	418.8	34.7	14.5
	0.2	0.0	881.3	390.0	30.8	19.0
		5	968.8	415.0	18.3	5.0
	Mean		925.1	402.5	24.6	12.0
Mean			922.6	410.7	29.7	13.3
0.2	0.0	0.0	1008.8	420.0	42.5	29.0
		5	853.8	395.0	20.8	12.0
	Mean		931.3	407.5	31.7	20.5
	0.2	0.0	970.0	432.5	19.3	26.0
		5	796.3	412.5	9.3	20.0
	Mean		883.2	422.5	14.3	23.0
Mean			907.3	415.0	23.0	21.8
Total mean			915.0	412.9	26.4	17.6

Mean of BA

BA	0.0	925.7	413.2	33.2	17.5
BA	0.2	904.2	412.5	19.5	17.5

GA3	0.0	962.2	417.5	33.6	22.0
GA3	5	867.6	408.1	14.5	13.0

ıtment associated with the less accumulation of N, P, K, Fe and Zn, while this combined ıtment associated with slight relatively higher accumulation of Mg, Mn and Cu. This ding may be attributed to the role of such combined treatment on the absorption of ferent nutrients. In other words, the modifing effect of IBA + BA on rooting ability was tended to the accumulation of nutrients in ***Scindapsus aureus*** plant tissues.

As a general GA_3 application stimulated higher concentration of N, K, Ca, while ch treatment, minimized greatly the accumulations of other nutrients. The same nclusion may be observed by as a general the addition of BA.

ombined effect of IBA, BA and GA_3 on the concentration of carbohydrate fractions in cindapsus aureus plant tissues after 28 days of incubation under water culture onditions (Table, 53).

As a general and irrespective to other treatments, BA and GA3 at the rate of 0.2 and ppm respectively minimized the accumulation of total carbohydrate as compared to the).0 ppm treated cuttings. This decline, was related to the depressive effect of such reatments on the hydrolizable carbohydrate (poly - saccharides).

On the other hand, IBA at the rate of 0.2 ppm enhanced the accumulation of total carbohydrate over 0.0 ppm treated cuttings and that was connected with the higher poly-saccharides. These results indicate that the three tested growth regulators affected the carbohydrate fractions metabolism in ***Scindapsus aureus*** cuttings, and that reflected their effects on the ability of cuttings to rooting.

As mentioned before in (Table, 45), all of the cultivated cuttings formed roots, when the cuttings were subjected under the treatments with0.2 + 0.2 + 0.0 ppm of IBA, BA and GA_3 respectively. This treatment stimulated greatly the higher accumulation of different carbohydrate fractions in the plantlets after 28 days of incubation. At the same time, the lowest rooted cuttings ability was connected with the lowest accumulated, carbohydrate fractions by using 0.2 + 0.2 + 5 ppm of IBA, BA and GA_3 respectively.

Table(53): Combined effect of IBA, BA and GA_3 on the concentration of carbohydrate fractions in *Scindapsus aureus* plant tissues after 28 days of incubation under water culture conditions.

Substance (PPm)			Mg/grdry weight				
IBA	BA	GA3	R.S.	N.R.S.	T.S.	H.C.	T.C.
0.0	0.0	0.0	36.8	50.0	86.6	110.3	196.9
		5	23.6	42.0	65.6	34.2	99.8
	Mean		30.2	46.0	76.1	72.3	148.4
	0.2	0.0	34.1	23.7	57.8	112.8	170.6
		5	28.9	34.1	63.0	81.4	144.4
	Mean		31.5	28.9	60.4	97.1	157.5
Mean			30.9	37.5	68.3	84.7	153.0
0.2	0.0	0.0	31.5	31.5	63.0	133.9	196.9
		5	21.0	18.4	39.4	118.1	157.5
	Mean		26.3	25.0	51.2	126.0	177.2
	0.2	0.0	42.0	34.1	76.1	99.8	175.9
		5	36.8	18.3	55.1	89.3	144.4
	Mean		39.4	26.2	65.6	94.6	160.2
Mean			32.9	25.6	58.4	110.3	168.7
Total mean			31.9	31.6	63.4	97.5	160.9

Mean of BA

BA	0.0	28.3	35.5	63.7	99.7	162.8
BA	0.2	35.5	27.6	63.0	89.7	158.9

Mean of GA3

GA3	0.0	36.1	69.7	70.9	114.2	185.1
GA3	5	27.6	28.2	55.8	80.8	136.5

R .= Reducing ,S.=Sugars ,N.=None ,T.= Tatal H.= Hydrolizable
C .= Carbohydrate

These results, again indicate that carbohydrate content may play an important role rooting ability of ***Scindapsus aureus***, as a great regulatory effect on carbohydrate ctions was gained by the used growth regulators. In addition, it was suggested that the pressive effect of GA_3 on rooting ability may be related, partially, to its depressive effect different carbohydrate fraction accumulations, as it could be assumed that the depressive ect of GA_3 at the rate of 5 ppm was dominant and reduced greatly the stimulatory effect other two growth regulators.

mbined effect of IBA, BA and GA_3 on the concentration of free - bound - and total nino acid fractions in Scindapsus aureus plant, tissues after 28 days of incubation nder water culture conditions (Tables, 54, 55 & 56).

could be conculded the following conclusion:

- Free, bound and total amino acids fractions were affected by the applications of BA, BA, GA_3 and their probable combinations, and that may, partially, play an important ole with the rooting ability of ***Scindapsus aureus*** cuttings.

- The highest rooting ability of ***Scindapsus aureus*** was gained when the cuttings were subjected under the treatment with 0.2 + 0.2 + 0.0 ppm of IBA, BA and GA_3 respectively. Such treatment lowered the total accumulated bound and total fractions of amino acids in the rooted cuttings. At some time, the lowest rooting ability was gained under the treatment with 0.2 + 0.2 + 5 ppm. IBA, BA and GA3 respectively and that was associated with the relatively highest accumulated amounts of bound and total amino acids in plantlet tissues. In other words, the lower the total amino acid formations, the higher the rooting ability was going, and the vice versa was true. This finding leads us to the assumption that different amino acid fractions seemed to have a partial role in the rooting ability of ***Scindapsus aureus*** cuttings under the conditions of this experiment.

Again, the highest rooting ability was gained under higher carbohydrate and lower amino acids accumulations.

- The used growth regulators controled the formation of different amino acids fractions especially the proteinous amino acids, i.e. affected protein assimilation. Auxins,

Table (54): Combined effect of IBA and Co A_3 on the concentration of free amino acids fractions in *Scindapsus aureus* after 28 days of incubation under water cultures conditions.

IBA (ppm)	BA (ppm)	GA_3 (ppm)	mg / gr dry weight													
			Glycine	Threonine	Alanine	Serine+Aspartic	Valine+Methionine	Leucine+Isoleucine	Phenyl alanine	Tyrosine	Cysteine	Proline	Glutamic	Histidine+Arginine	Lysine	Total
0.0	0.0	0	0.37	0.26	---	0.26	0.34	0.22	---	0.28	---	---	---	0.20	0.20	2.13
		5	0.13	0.41	0.37	0.17	0.43	0.28	0.20	0.30	---	0.04	0.30	0.26	0.17	3.06
	Mean		0.25	0.34	0.19	0.22	0.39	0.25	0.10	0.29	---	0.02	0.15	0.23	0.19	2.62
	0.2	0	0.26	0.32	0.17	0.24	0.19	0.41	0.19	0.26	0.04	---	0.20	0.26	0.20	2.74
		5	---	0.26	---	0.41	0.28	0.42	0.07	0.39	0.06	0.04	---	0.30	0.20	2.43
	Mean		0.13	0.29	0.09	0.33	0.24	0.42	0.13	0.33	0.05	0.02	0.10	0.28	0.20	2.61
Mean			0.19	0.32	0.14	0.28	0.32	0.34	0.12	0.31	0.03	0.02	0.13	0.26	0.20	2.66
0.2	0.0	0	0.39	0.26	0.30	0.39	0.26	0.37	0.04	0.41	0.07	0.06	0.26	0.32	0.07	3.20
		5	0.30	0.30	0.26	0.41	0.26	0.37	0.15	0.39	0.11	0.06	0.20	0.32	0.17	3.30
	Mean		0.35	0.28	0.28	0.40	0.26	0.37	0.10	0.40	0.09	0.06	0.23	0.32	0.12	3.26
	0.2	0	0.11	0.37	0.13	0.35	0.30	0.34	0.22	0.43	0.04	0.02	0.17	0.28	0.20	2.96
		5	0.17	0.28	0.20	0.28	0.30	0.30	0.17	0.28	0.07	0.09	0.24	0.24	0.13	2.79
	Mean		0.14	0.33	0.17	0.32	0.30	0.32	0.20	0.36	0.06	0.06	0.21	0.26	0.17	2.90
Mean			0.25	0.31	0.23	0.36	0.28	0.35	0.15	0.38	0.08	0.06	0.22	0.29	0.15	3.11
Total Mean			0.22	0.32	0.19	0.32	0.30	0.35	0.14	0.35	0.06	0.04	0.18	0.28	0.18	2.93

Mean of BA

BA (ppm)															
0.0	0.30	0.31	0.24	0.31	0.33	0.31	0.10	0.35	0.05	0.04	0.19	0.28	0.16	2.97
0.2	0.14	0.31	0.13	0.33	0.27	0.37	0.17	0.35	0.06	0.04	0.16	0.27	0.19	2.79

Mean of BA

GA_3 (ppm)														
0	0.28	0.30	0.15	0.31	0.27	0.34	0.11	0.35	0.04	0.02	0.16	0.27	0.17	2.76
5	0.15	0.31	0.21	0.32	0.32	0.34	0.15	0.34	0.06	0.06	0.19	0.28	0.17	2.92

Table (55): Combined effect of IBA , BA and GA_3 on the concentration of bound amino acids fractions in *Scindapsus aureus* plant tissues after 28 days of incubation under water cultures conditions.

IBA (ppm)	BA (ppm)	GA_3 (ppm)	Glycine	Threonine	Alanine	Serine+Aspartic	Ualine+Methionine	Leucine+Isoleucine+phenylalanin	Tyrosine	Cysteine	Proline	Glutamic	Histidine+Arginine	Lysine	Total
0.0	0.0	0	15.16	13.06	11.18	4.40	8.36	18.41	4.07	3.42	9.52	4.04	4.77	1.35	97.74
		5	14.16	12.01	10.50	4.80	7.02	16.29	4.67	3.11	13.06	5.29	4.71	1.69	97.31
	Mean		14.66	12.54	10.84	4.60	7.69	17.35	4.37	3.27	11.29	4.67	4.74	1.52	97.54
	0.2	0	9.06	12.10	12.56	4.11	10.99	19.28	5.64	1.82	15.48	3.53	4.09	1.35	100.01
		5	9.01	11.54	11.49	2.70	9.35	15.04	4.58	2.42	16.63	4.35	3.74	1.35	92.19
	Mean		9.04	11.82	12.03	3.41	10.17	17.16	5.11	2.12	16.06	3.94	3.91	1.35	96.12
Mean			11.85	12.18	11.44	4.01	8.93	17.26	4.74	2.70	13.68	4.31	4.33	1.44	96.87
0.2	0.0	0	9.24	4.08	4.67	1.16	3.78	7.69	2.39	1.79	13.04	1.91	1.54	0.55	51.84
		5	10.57	13.36	12.16	3.94	10.30	19.70	5.51	1.75	13.04	5.08	4.65	1.38	101.44
	Mean		9.91	8.72	8.42	2.55	7.04	13.70	3.95	1.77	13.04	3.50	3.10	0.97	76.67
	0.2	0	5.48	8.33	8.57	2.76	7.46	14.97	2.99	2.13	10.69	2.00	3.45	0.73	69.56
		5	11.01	14.01	7.25	4.07	7.77	18.78	4.38	2.73	9.43	5.97	4.73	1.11	91.24
	Mean		8.25	11.17	7.91	3.42	7.62	16.88	3.69	2.43	10.06	3.99	4.09	0.92	80.43
Mean			9.08	9.95	8.17	2.99	7.33	15.29	3.82	2.10	11.55	3.75	3.60	0.95	78.56
Total Mean			10.47	11.07	9.81	3.50	8.13	16.28	4.28	2.40	12.62	4.03	3.97	1.20	87.76
BA (ppm)	0.0		12.29	10.63	9.63	3.58	7.37	15.53	4.16	2.52	12.17	4.09	3.92	1.25	87.14
	0.2		8.65	11.07	9.97	3.42	8.90	17.02	4.40	2.28	13.06	3.97	4.0	1.14	87.88
GA_3 (ppm)	0		9.74	9.39	9.25	3.11	7.65	15.09	3.77	2.29	12.18	2.87	3.49	1.00	79.83
	5		11.19	12.73	10.35	3.88	8.61	17.45	4.79	2.50	13.04	5.17	4.46	1.38	95.55

Table (56): Combined effect of IBA , BA and GA_3 on the concentration of total amino acids fractions in ***Scindapsus aureus*** plant tissues after 28 days of incubation under water cultures conditions.

IBA (ppm)	BA (ppm)	GA_3 (ppm)	Glycine	Threonine	Alanine	Serine+Aspartic	Valine+Methionin	Leucine+Isodeuic	Tyrosine	Cysteine	Proline	Glutamic	Histidine	Lysine	Total
0.0	0.0	0	15.53	13.32	11.18	4.466	8.70	18.63	4.35	3.42	9.52	4.04	4.97	1.55	100.07
		5	14.29	12.42	10.87	4.97	7.45	16.77	4.97	3.11	13.10	5.59	4.97	1.86	100.37
	Mean		14.91	12.87	11.03	4.82	8.08	17.70	4.66	3.27	11.31	4.82	4.97	1.71	100.15
	0.2	0	9.32	12.42	12.73	4.35	11.18	19.88	5.90	1.86	15.48	3.73	4.35	1.55	102.75
		5	9.01	11.80	11.49	3.11	9.63	15.53	4.97	2.48	16.67	4.35	4.04	1.55	94.63
	Mean		9.17	12.11	12.11	3.73	10.41	17.71	5.44	2.17	16.08	4.04	4.20	1.55	98.72
Mean			12.04	12.49	11.57	4.28	9.25	17.71	5.05	2.72	13.70	4.43	4.59	1.63	99.46
0.2	0.0	0	9.63	4.34	4.97	1.55	4.04	8.07	2.80	1.86	13.10	2.17	1.86	0.62	55.01
		5	10.87	13.66	12.42	4.35	10.56	20.19	5.90	1.86	13.10	5.28	4.97	1.55	104.71
	Mean		10.25	9.00	8.70	2.95	7.30	14.31	4.35	1.86	13.10	3.73	3.42	1.09	79.85
	0.2	0	5.59	8.70	8.70	3.11	7.76	15.53	3.42	2.17	10.71	2.17	3.73	0.93	72.52
		5	11.18	14.29	7.45	4.35	8.07	19.25	4.66	2.80	9.52	6.21	4.97	1.24	93.99
	Mean		8.39	11.50	8.08	3.73	7.92	17.39	4.04	2.49	10.12	4.19	4.35	1.09	83.29
Mean			9.32	10.25	8.39	3.34	7.61	15.76	4.20	2.18	11.61	3.96	3.89	1.09	81.60
Total Mean			10.68	11.37	9.98	3.81	8.43	16.74	4.63	2.45	12.66	4.20	4.24	1.36	90.55

Mean of BA

BA (ppm)	0.0	12.58	10.94	9.87	3.89	7.69	15.92	4.51	2.57	12.21	4.28	4.20	1.40	90.06
	0.2	8.78	11.81	10.10	3.73	9.17	17.55	4.74	2.33	13.10	4.12	4.28	1.32	91.03

Mean of GA3

GA_3 (ppm)	0	10.02	9.70	9.40	3.42	7.92	15.53	4.12	2.33	12.20	3.03	3.73	1.16	82.56
	5	11.33	13.04	10.56	4.20	8.93	17.94	5.13	2.56	13.10	5.36	4.74	1.55	98.44

berellins and cytokinins may interact at the gene level **(Devlin & Witham, 1983)**, as ir action in regulating growth is associated with nucleic acid metabolism and new protein mation, including different enzymes which affected greatly the net gain of total plant tabolism, and the accumulation of different organic matter.

-As the balance between the applied exogenous and endogenous growth regulators very important to detect their proportional control either on plant growth behaviour or its etabolic reactions, hence it was gained a great variable differences in free - bound and tal amino acids fractions by using a great combinations between the three used growth romoters.

-The effect of auxins, gibberellins ad cytokinins on nuclic acids and protein iosynthesis was obtained by many workers, among them: **(Key & Shannon, 1964; De Iertogh, *et al.*, 1965; Coartney, *et al.*, 1967; Masuda, *et al.*, 1967; Sacher, 1967- a &); Shimoda, *et al.*, 1967; Nooden, 1968; Hendry, *et al.*, 1977 and Witham, *et al.*, 1978),** all working on auxins. In addition, among the workers studied the effect of GA_3 on nuclice acids and protien synthesis were, **(Varner, *et al.*, 1965; Chrispeels & Varner, 1966 & 1967, a-b; Jacobsen & Varner, 1967; Evins & Varner, 1972; Brown & Sun, 1973; Varner & Ho, 1976; Hendry, *et al.*, 1977; Jacobsen, 1977 and Witham, *et al.*, 1978)** studied the effect of cytokinins on nuclice acids and protein biosynthesis.

In spite of the above mentioned information, very little is known about the combined effect of such three growth promoting substances and the balance between them with plant metabolism relationships.

Experiment III B.c:

Combined effect of IBA and some growth co-factors on rooting ability of ***Scindapsus aureus*** and ***Philedondron scandens***

It was found from the previous experiment that BA synergized IBA - induced rooting ability of ***Scindapsus aureus*** when both were used in equal proportion (1:1) at relatively very low level (0.2 + 0.2 ppm of both), as the rooting ability reached 100%. However, many growth co-factors may modify rooting ability of many plant species cutting. These growth co-factors including phenolic compounds and vitamin B_1 and B_6.

Doubtless endogenous and exogenous phenols modify plant growth in several bio-ssays, and they participate in many complicated chains of reactions which are reflected on /hole processes of plant metabolism, (including endogenous auxin levels), and its evelopment (see the detail information in review of literature). The action of such growth :o-factors as in growth regulators depends upon their used levels, as the relatively low level ;timulates plant growth, while the relatively high level depresses it.

The above mentioned information leads us to extend our study to include the combined effect of IBA with some phenolic compounds, (catechol, pyrogallol and coumarin), and mixture of vitamin $B_1 + B_6$. The used rate of every growth co-factor is 0.5 ppm in the presence or absence of 0.2 ppm IBA, as discussed before in materials and methods.

(A) combined effect of IBA and some co-factors on rooting ability of Scindapsus aureus

Rooting ability (Table, 57).

As a general, most of the used growth co-factors synergized the stimulatory effect of IBA on rooting initiation and formation in ***Scindapsus aureus*** cuttings especially when catechol or mixture of vit. $B_1 + B_6$ were added in the water culture medium with 0.2 ppm. IBA, as the rooting ability reached 100% success. In addition, the best result was gained by using 0.2 ppm IBA with vits. $B_1 + B_6$ as higher early root initiation was obtained, as 100% of the tested rooting cuttings were obtained after only 21 days of incubation.

Also, complete success of cutting was obtained by using all tested phenolic compounds alone, i.e. in the absence of IBA. However, the use of vit. B mixture alone seemed to have a depressive effect on rooting ability of ***Scindapsus aureus*** cutting.

The complete success of ***Scindapsus aureus*** cuttings under the subjection of all tested phenolic compounds may be discussed on the basis that phenolic compounds act directly on the biosynthesis of endogenous auxin from tryptophan **(Gordon & Plaleg, 1961 and Gorter, 1969)**. However, some workers postulated that phenolic compounds acted as anti-endogenous auxin oxidates through an enzymatic process as anti.-IAA oxidase enzymes **(Tomaszewski & Thimann, 1966; Stutz, 1957 and Van Over bek, 1966).**

Table (57): Combined effect of IBA and some co-factors on the percentage of rooting ability of *Scindapsus aureus* cuttings, during different periods of water culture incubation.

IBA (ppm)	Co- factor (0.5 ppm)	Days of incubation				
		7	14	21	28	35
0.0	Without	33.3	55.6	66.7	77.8	77.8
	Catechol	55.6	66.7	88.9	88.9	100.0
	Pyrogallol	22.2	22.2	88.9	100.0	100.0
	Coumarin	66.7	66.7	77.8	100.0	100.0
	Vits B_1 +B_6	33.3	33.3	55.6	55.6	66.7
Average		44.5	47.2	77.8	86.1	91.7
0.2	Without	44.4	55.6	77.8	88.9	88.9
	Catechol	77.8	77.8	88.9	100.0	100.0
	Pyrogallal	33.3	33.3	88.9	88.9	88.9
	Coumarin	44.4	44.4	77.8	77.8	88.9
	Vits .B_1+B_6	77.8	77.8	100.0	100.0	100.0
Average		58.3	58.3	88.9	91.7	94.5

L.S.D. 5%between: IBA (I) = 0.2
Co- factors(C) = 0.3
Period (p) = 0.4
I*C = 0.9
I*P = 0.9
C*P = 1.0
I*C*P = 1.3

With regards to the synergistic effect of vits. $B_1 + B_6$ on the IBA stimulatory effect of ***Scindapsus aureus*** cuttings success it must be mentioned that vits. $B_1 + B_6$ are mostly synthesied in roots and play an important role as metabolic co-factors in different plant organs. Thus, exogenous application must be applied to the excised plant segment such as cuttings to be grown normally. It was suggested that the application of IBA at very low rate (0.2 ppm) with 0.5 ppm mixture of vits. $B_1 + B_6$ (0.25 + 0.25 of both) leads to the complete and early success of ***Scindapsus aureus*** cuttings through a definite proper endogenous metabolic changes.

Number of roots per one cutting (Table, 58)

It is clear from the data that combined effects of IBA and co-factors not only affect the rooting ability of ***Scindapses aureus*** but also affect the number of root initiation and its formation. The highest the rooting ability, the high root number formation was gained, and the vice versa was mostly true. The highest root production was gained by the applicaiton of 0.2 ppm IBA + vit $B_1 + B_6$, and the lowest one was gained by 0.0 ppm IBA in the absence of co-factors. In spite of the lowest value in rooted cuttings by the application of vit $B_1 + B_6$ alone, however, higher root production was gained at the end of water culture incubation.

Fresh and dry weights of roots per one cutting (Table, 58):

Different treatments affected the fresh and dry weights of the formed roots at the end of water culture incubation (35 days). The highest fresh and dry weights was gained by the combined treatment with IBA plus vits. $B_1 + B_6$ at the rates of 0.2 ppm. + (0.25 + 0.25 ppm) respectively. This indicates that vitamin $B_1 + B_6$ synergized the effect of IBA on root development and its growth.

Root length (per one root) and total root lengths (per one cutting) cm (Table, 59)

As it was found that different treatments with co-factors in the presence or absence of IBA affected the rooting ability of ***Scindapsus aureus,*** it was also found that such treatments affected the number of the formed number of root initiation in every cutting, thus this study was extended to define the root length per one root and the total lengths of roots

Table (58): Combined effect of IBA and some co-factors on the number of formed roots per one cutting of *Scindapsus aureus* during different periods of water culture incubation as well as fresh and dry weight of roots per one cutting after 35 days.

IBA (ppm)	Co- factor (0.5 ppm)	Days of incubation					weight of root/ 1cutingat35days	
		7	14	21	28	35	fres(gr	Dry(gr)
0.0	Without	0.33	0.67	0.89	1.89	2.56	0.161	0.0159
	Catechol	0.67	1.33	2.00	2.44	4.67	0.215	0.0215
	Pyrogallol	0.22	0.78	1.33	1.56	4.67	0.210	0.0203
	Coumarin	0.67	1.00	1.55	2.67	6.22	0.227	0.0244
	Vits B_1 +B_6	0.33	0.67	0.89	1.56	7.78	0.239	0.0250
Average		0.47	0.95	1.44	2.06	5.84	0.223	0.0200
0.2	Without	0.67	1.22	1.67	1.89	5.33	0.291	0.0276
	Catechol	0.78	1.11	1.44	1.67	5.56	0.227	0.0280
	Pyrogallol	0.33	1.11	1.44	1.78	5.78	0.235	0.0248
	Coumarin	0.44	0.89	1.44	1.78	4.78	0.220	0.0207
	Vits .B_1+B_6	0.78	1.67	2.00	2.11	7.90	0.305	0.0367
Average		0.58	1.20	1.58	1.84	6.01	0.247	0.0276

L.S.D. 5% between: IBA (I) = 0.01
Co- factors (C) = 0.02
Period (p) = 0.02
I*C = 0.04
I*P = 0.04
C*P = 0.05
I*C*P = 0.08

Table (59): Combined effect of IBA and some co-factors on the formed root length per one root and the total root lengthes per one cutting of *Scindapsus aureus* during different periods of water culture incubation

(days of incubations).

IBA (ppm)	Co- factor (0.5 ppm)	Root length cm/per one root				Total root length / one cutting (cm)			
		14	21	28	35	14	21	28	35
0.0	Without	2.3	2.9	3.1	2.9	1.54	2.58	5.86	7.42
	Catechol	3.6	5.0	4.3	2.7	4.79	10.0	10.49	12.61
	Pyrogallol	2.5	4.0	4.0	2.2	1.95	5.32	6.24	10.27
	Coumarin	3.4	6.0	3.8	2.0	3.40	9.30	10.15	12.44
	Vits B_1 +B_6	3.9	5.5	3.3	2.2	2.61	4.90	5.15	17.12
	Average	3.35	5.13	3.85	2.28	3.19	7.38	8.01	13.11
0.2	Without	2.6	3.2	4.3	1.9	3.17	5.34	8.13	10.13
	Catechol	1.8	5.2	4.9	2.1	2.00	7.49	8.18	11.68
	Pyrogallol	2.6	4.8	5.3	1.9	2.89	6.91	9.43	10.98
	Coumarin	4.7	4.4	4.4	2.4	4.18	6.34	7.83	11.47
	Vits B_1+B_6	2.8	5.3	5.7	2.3	4.67	10.6	12.03	16.17
	Average	2.98	4.93	5.08	2.18	3.44	7.84	9.37	13.08

L.S.D.5% between:			
IBA (1)	=0.01	0.10	
Cofactors(C)	=0.03	0.30	
periods (P)	=0.05	0.30	
I*C	=0.10	0.40	
I*P	=0.10	0.30	
C*P	=0.10	0.30	
I*C*P	=0.20	0.40	

per one cutting, as the strong root formation affected the growth behaviour during pot stage.

It could be concluded that different treatments showed less conspicuous effect on root length per one root, however total root lengthes per one cutting were greatly affected by different treatments, as the more number of roots formed the more root lengths were obtained. The highest root lengthes per one cutting, at the end of water culture incubation were gained either by the presence of vits. $B_1 + B_6$ alone or in the presence of 0.2 ppm. IBA.

It may also stated that total root lengthes per one cutting was progressively increased during the successive periods of incubations under water culture conditions as new formed roots was continued throughout such period. On the other hand, root length per one root showed some decline at the end of water culture incubation and that was mainly related to the very small new formed roots which initiated later on the cutting, as continous root formation was obtained till the end of water culture incubation (Table, 58).

Percentage increase in fresh weight/one cutting as related to the start sample (Table, 60)

During water culture conditions enough of water was more available to the cuttings of such semi-hydrophitic plant. Accordingly, fresh weight and absorption of water seemed to be controlled by the different treatments. As a general, fresh weight per one cutting increased continuously with advancing age till it reached the maximum at the end of water culture incubations.

It could be mentioned that different treatments must have affected the plant metabolism leading to either water absorption rate or (and) the accumulation of dry matter. It must be mentioned that great variation in the percentage increase in fresh weight as related to start sample was obtained by the using differnt treatment. The best indication of cutting growth may be obtained by the percentage increase of dry matter.

Percentage increase in dry weight/one cutting as related to the start sample (Table, 61)

It could be stated that different treatments affected the dry matter accumulation throughout the different periods of water culture incubation of one leaf soft stem cuttings of ***Scindapsus aureus***. This indicates that the different organic matter which assimilated in

Table (60): Combined effect of IBA and some co-factors on the percentage increase in fresh weight as related to start sample of *Scindapsus aureus* cutting, during different periods of water culture incubation.

IBA (ppm)	Co- factor (0.5 ppm)	Days of incubations				
		7	14	21	28	35
0.0	Without	10.7	12.1	12.5	36.1	44.6
	Catechol	11.5	20.4	22.6	29.8	41.7
	Pyrogallol	9.9	15.6	23.4	25.1	35.1
	Coumarin	10.2	19.0	24.7	36.6	56.9
	Vits B_1 +B_6	12.1	18.6	22.7	38.8	51.9
Average		10.9	18.4	23.4	32.6	46.4
0.2	Without	9.0	20.4	28.8	39.5	53.2
	Catechol	8.8	18.5	22.9	29.5	41.4
	Pyrogallol	9.9	14.3	22.7	27.7	50.0
	Coumarin	13.1	15.3	21.6	23.4	52.0
	Vits .B_1+B_6	12.9	24.5	28.6	38.4	55.7
Average		11.2	18.2	24.0	29.8	49.8

Table (61): Combined effect of IBA and some co-factors on the percentage increase of dry matter of *Scindapsus aureus* cuttings, during different periods of water culture incubation.

IBA (ppm)	Co- factor (0.5 ppm)	Days of incubations				
		7	14	21	28	35
0.0	Without	12.4	15.5	21.9	48.6	64.6
	Catechol	13.2	24.1	30.1	41.8	59.2
	Pyrogallol	11.6	19.1	23.1	36.7	39.2
	Coumarin	11.8	22.6	32.3	49.1	61.7
	Vits. B_1 +B_6	12.4	20.7	28.6	49.9	75.4
	Average	12.3	21.6	28.5	44.4	58.9
0.2	Without	10.7	24.1	36.7	52.4	93.4
	Catechol	10.5	22.2	30.5	41.5	48.0
	Pyrogallol	11.6	17.7	20.4	39.4	50.0
	Coumarin	14.8	18.8	21.9	34.7	77.7
	Vits. B_1+B_6	14.6	28.4	34.1	51.1	74.8
	Average	12.9	21.8	26.7	41.7	62.6

green leaf and stem increased with advancing age till it reached the maximum at the end of water culture incubution. In addition, the rate of such increment was greatly differed according to the application of co-factors and the presence or absence of IBA. The dry matter accumulation rate is an expression of the net gain of the difference between the assimlation compounds and the rate of their consumption especially during respiration. Accordingly, it was not showed clear corelation between the cutting success and the rate of dry matter percentage increment. While it was observed the higher increase in dry weight proportion by using the combination of 0.2 ppm IBA + vits B_1 + B_2 (0.25 + 0.25 ppm of both) which associated with early and complete success of ***Scindapsus aureus*** cuttings. On the other hand, the complete success of cuttings was also gained by other treatments, (i.e. by using phenolic compounds in the absence of IBA), however, variable dry matter accumulation rates was gained by such treatments, as for example pyrogallol depressed greatly the accumulation of dry matter proportion comparing to those corresponding ones of the treatments including control. In addition, the lowest rooting ability was gained by using vits B_1 + B_6 alone, and that associated with the higher accumulation of dry matter proportion.

Finally, it may conclude that different co-factors affecting plant metabolism by differences in their mode of action and that plays an important role in the proportion of cutting success. In other words, the mechanism of action of the using differnt co-factors including IBA on the rooting ability of ***Scindapsus aureus*** one leaf soft cuttings was quite different from one to another.

As it was tested co-factors under the conditions of this experiment affected the root initiation, and total length, i.e. the water and nutrient absorption organ, thus, this study was extended to include the concentration of some nutrient at the end of water culture phase, i.e. after 35 days of incubation.

The concentration of some nutrients after 35 days of incubation (Table, 62)

I may be concluded the following conclusions:

- The concentration of different nutrients was changed by the application of different treatments under the conditions of this experiment in ***Scindapsus aureus*** cutting tissues.

Table (62): Combined effect of IBA and some co-factors on the concentration of some nutrients of *Scindapsus aureus* cutting, at the end of water culture incubations.

IBA (ppm)	Co- factor (0.5 ppm)	mg-/gr. dry weight					mg/gr. dry weight			
		N	P	K	Ca	Mg	Fe	Mn	Zn	Cu
0.0	Without	20.3	1.06	69.0	30.68	1.065	632.5	165.0	20.0	25.0
	Catechol	22.4	1.25	70.3	30.68	1.160	585.0	145.0	25.0	7.5
	Pyrogallol	23.1	1.68	76.2	30.68	1.090	712.5	182.5	30.0	7.5
	Coumarin	23.1	1.14	62.7	24.57	1.068	625.0	120.0	25.0	5.0
	Vits B_1+B_6	24.5	1.21	79.1	30.68	1.188	755.0	135.0	35.0	12.5
Average		23.28	1.32	72.1	29.15	1.127	669.3	145.6	28.8	8.1
0.2	Without	35.0	1.64	69.4	30.75	1.260	607.5	155.0	15.0	22.5
	Catechol	19.6	1.82	75.7	24.57	1.250	812.5	162.5	42.5	5.0
	Pyrogallol	15.4	1.68	52.3	21.50	1.188	697.5	172.5	57.5	5.0
	Coumarin	24.5	1.53	66.7	18.38	1.350	520.0	150.0	10.0	20.0
	Vits $.B_1+B_6$	22.4	1.39	69.3	24.57	1.315	675.0	137.5	25.0	17.5
Average		20.48	1.61	66.0	22.26	1.276	676.3	155.6	33.8	11.9

- Many treatments lowered the accumulation of N in cutting tissues such as the combination of IBA plus catechol or pyrogallol, while other treatments stimulated such accumulation.

- It was found that fine changes occurred in ply different treatments, however, most treatments stimulated relatively more P accumulation as compared to control one.

- Many treatments increased relatively the accumulation of K over the control one, while others lowered such accumulation under the control one. The same conclusion was stated in the case of Ca, Mg, Fe, Mn, Zn and Cu. These results may indicate that the application of co-factors either alone or in combination with IBA at the rate of 0.2 ppm affected the accumulation and/or the absorption rates of different nutrients without clear trends.

- The highest accumulation of nutrients, as a general, seemed to be K followed mostly by Ca, N, Fe, Mn, Zn while Cu was the least one in this respect. In addition and as a general Fe accumulation seemed to be about four times of Mn, while Mn accumulation seemed to be five times of Zn, while Zn accumulation seemed to be three times of Cu, under the conditions of this experiment (as the total mean of the elements irrespective to other factors). It must be mentioned that different treatments affected the above mentioned proportions of the tested elements accumulated in ***Scindapsus aureus*** cuttings under water culture conditions in the absence of O_2 in root medium of such semi-hydrophitic plants.

On the same basis, K seemed to be about three times of N while the proportion of Ca was about 37% of K, under the same conditions of water culture incubation. Of cource many factors affecting the absorption rates of nutrients which included partially the plant metabolic activities, the PH value of the root medium, the availability of the nutrients ....etc. Accordingly, it may conclude that, co-factors and IBA affected the rate of nutrient uptake and the balance between the accumulation rates within plant tissues, and the conditions of root medium under water culture conditions interfered with their actions in this respect.

Combined effect of IBA and some co-factors on the new formed leaves of Scindapsus aureus during differnt periods of growth under pot culture conditions (Table, 63)

The complete success of cuttings may be defined by the appearance of adventitious roots, however, different treatments which affected the rooting ability may regulate the

'able (63): Combined effect of IBA and some co-factors on the number of new formed leaves of *Scindapsus aureus* plants during different periods of growth water pat culture incubation.

IBA (ppm)	Co- factor (0.5 ppm)	Weeks under pot culture conditions							
		2	4	6	8	10	12	14	16
0.0	Without	1.0	1.5	2.5	3.8	5.3	6.8	8.5	9.5
	Catechol	1.5	2.3	3.5	5.0	6.3	7.8	9.3	10.5
	Pyrogallol	1.5	2.5	3.8	5.3	6.8	8.3	10.0	12.5
	Coumarin	1.3	2.3	3.5	5.0	6.5	8.3	10.0	13.0
	Vits B_1 +B_6	2.3	3.3	4.5	6.0	7.5	9.0	11.0	13.8
	Average	1.7	2.6	3.8	5.3	6.8	8.4	10.1	12.5
0.2	Without	2.0	3.0	4.3	5.8	7.3	8.8	10.3	12.0
	Catechol	2.3	3.3	4.5	6.0	7.5	9.0	10.8	13.3
	Pyrogallol	2.0	3.0	4.8	6.3	7.8	9.3	11.3	13.8
	Coumarin	2.5	3.8	5.0	6.5	8.3	9.8	12.0	14.0
	Vits .B_1+B_6	2.8	4.5	5.8	7.8	9.0	10.5	13.0	14.5
	Average	2.4	3.7	5.0	6.7	8.2	9.7	11.8	13.9

L.S.D.5% between: IBA (I) =0.01
Cofactors(C) =0.03
periods (P) =0.04
I*C =0.10
I*P =0.20
C*P =0.30
I*C*P =1.60

growth behaviour of the resulted rooted cuttings during the pot phase conditions accordingly, this results was extended to show the after-effect on the used treatment on the growth behaviour in the terms of new formed leaves per one plant, as well as the stem length. These data were collected every two weeks until marketable stage which extended into 16 weeks, i.e. 112 days from trans planting the rooted cuttings (The total duration of this experiment was 35 days under culture conditions plus 112 days under pot culture conditions, i.e. with the total duration of 147 days).

It may be concluded that the new formed leaves increased gradually from the beginning till the end of 112 days from retransplanting. In addition, most treatments stimulated the higher leaves formations during different periods of growth as compared to those corresponding ones of untreated plants. The less stimulatory effect on new formed leaves was gained by catechol. At the same time the highest stimulatory effect in this respect was gained by using 0.2 ppm IBA + vits B_1 + B_6. It could be mentioned also that IBA alone stimulates higher leaves formation, but vits. B_1 + B_6 maximized such stimulatory effect of IBA, over any other co-factors.

Stem length during pot conditions (Table, 64)

The stimulatory effect of different treatments on new leaves formation was associated with the more stem elongation. The highest stem length was gained by using 0.2 pmm IBA plus vits. B_1 + B_6, while the lowest ones was gained by the untreated plants during different periods of growth. In addition, all of the treatments with co-factors either alone, orin the pesence of 0.2 IBA, stimulated stem length with different degrees or rates.

As a general, it may be suggested that co-factors with very low rate (0.5 ppm) either alone or in combination with relatively very low IBA concentration (0.2 ppm), affected the rooting ability of ***Scindapsus aureus*** cuttings which associated with great differences in growth behaviour either during water culture periods or during pot culture phase. It was also suggested that the mode of action of such co-factors seemed to be more or less quite different.

'able (64): Combined effect of IBA and some co-factors on the stem length of *Scindapsus aureus* plants during different periods of growth under pot culture conditions (cm/plant).

IBA (ppm)	Co- factor (0.5 ppm)	weeks under pot culture conditions							
		2	4	6	8	10	12	14	16
0.0	Without	1.2	2.6	3.5	5.6	7.9	10.1	18.4	25.7
	Catechol	1.8	3.4	5.6	7.4	8.9	13.4	19.6	28.8
	Pyrogallol	2.4	4.6	5.8	8.7	9.9	14.8	20.5	29.4
	Coumarin	1.9	2.9	4.9	6.8	8.4	12.9	20.6	26.8
	Vits B_1 +B_6	2.3	3.5	7.8	6.0	9.4	15.5	19.9	27.9
	Average	2.1	3.6	5.6	7.7	9.2	14.2	20.2	28.2
0.2	Without	1.9	3.1	5.2	7.3	8.7	10.9	19.9	26.5
	Catechol	1.8	3.8	5.6	8.4	9.6	14.4	20.7	28.1
	Pyrogallol	1.9	3.9	5.8	9.2	10.4	15.5	22.8	29.4
	Coumarin	1.9	4.4	6.3	10.4	11.1	16.3	25.1	30.1
	Vits B_1+B_6	2.0	5.0	6.9	11.3	12.4	19.5	26.7	32.6
	Average	1.9	4.3	6.2	9.8	10.9	16.4	23.8	30.1

L.S.D.5% between: IBA (I) =0.1
Cofactors(C) =0.2
periods (P) =0.4
I*C =0.6
I*P =0.7
C*P =0.8
I*C*P =1.2

(B) Combined effect of IBA and some co-factors on rooting ability of Philodendron scandens

Rooting ability (Table, 65)

As a general, rooted cuttings increased progressivly with advancing age under water culture conditions. The highest and complete success of cuttings were gained by many co-factors, i.e. by using catechol, pyrogallol, and vits. $B_1 + B_6$ alone. Complete success was also gained by using 0.2 ppm IBA alone or in combination with catechol, which synergized the early stimulatory effect of IBA. However, other co-factors except catechol lowered the stimulatory effect of IBA on rooting ability in ***Philodendron scandens***. These results showed some differences with those corresponding ones of ***Scindapsus aureus***. In addition, the response of plants to the application of growth regulators or co-factors are different from one species to another.

Number of formed roots per one cutting (Table, 66)

The formation of roots was continued from the beginning till the end of water culture periods. All of the treated cutting with IBA alone or with co-factors and those treated with co-factors alone possessed higher number of roots than untreated ones. However, the rate of root initiation and development differed greatly frome one treated cuttings to another. The highest number of roots was gained by those cuttings treated with IBA at 0.2 ppm and catechol at 0.5 ppm. This may be discussed on the basis that IBA or co-factors, not only affected the rooting ability of ***Philodendron scandens,*** but also affected the rate of root initiation on the cuttings, with variable effect according to the type of co-factor and its combination with IBA and the species of the tested plants.

Fresh and dry weights of roots one cutting at the end of water culture period (Table, 66)

The trend of fresh and dry weights of the formed roots per one cutting at the end of water culture period seemed to be more or less with the same trend of root number per one cutting as the result of different treatments. This means that the effect of different co-factors either alone or their combination with IBA was extended to include the fresh and dry weights of the formed roots.

Table (65): Combined effect of IBA and some co-factors on the percentage of rooted cuttings of *Philodendron scandens* during different periods of water culture incubations.

IBA (ppm)	Co- factor (0.5 ppm)	Days of incubations				
		7	14	21	28	35
0.0	Without	6.7	22.2	28.6	42.9	61.8
	Catechol	10.0	22.2	55.6	77.8	100.0
	Pyrogllol	10.0	22.2	55.6	100.0	100.0
	Coumarin	12.3	44.4	77.8	77.8	85.8
	Vits.B_1 +B_6	10.0	33.3	77.5	100.0	100.0
Average		10.6	30.5	66.6	88.9	96.5
0.2	Without	4.3	11.1	25.0	57.1	100.0
	Catechol	22.4	66.7	77.8	100.0	100.0
	Pyrogallal	10.2	22.2	25.0	83.3	90.1
	Coumarin	20.5	33.3	44.4	66.7	77.8
	Vits .B_1+B_6	11.3	28.6	37.5	57.1	85.7
Average		16.1	37.7	46.2	76.8	88.4

L.S.D. 5% between: IBA (I) = 0.3
Co- factors (C) = 0.4
Period (p) = 0.5
I*C = 0.5
I*P = 0.8
C*P = 1.1
I*C*P = 1.3

le (66): Combined effect of IBA and some co-factors on the number of formed roots per one cutting of *Philodondron scandens* during different periods of water culture incubation as well as fresh and dry weight of the formed roots at the end of water culture incubations (35 days).

IBA (ppm)	Co- factor (0.5 ppm)	Days of incubations					freshanddryweig -ht/1cuttingat35dayas	
		7	14	21	28	35	fresh(gr)	Dry(gr)
0.0	Without	0.3	0.5	0.6	0.9	0.9	0.111	0.0121
	Catechol	0.5	0.7	1.9	2.5	3.5	0.199	0.0214
	Pyrogallol	0.4	0.6	1.9	2.9	3.9	0.203	0.0241
	Coumarin	1.0	2.4	3.5	4.5	4.9	0.278	0.0291
	Vits B_1 +B_6	1.3	2.7	3.6	5.7	6.8	0.299	0.0301
Average		0.8	1.6	2.7	3.9	4.8	0.245	0.0262
0.2	Without	0.1	0.6	0.8	3.1	3.9	0.215	0.0253
	Catechol	1.4	2.5	3.6	4.9	7.9	0.352	0.0378
	Pyrogallol	0.6	1.2	1.9	2.8	3.4	0.241	0.0252
	Coumarin	0.8	1.7	2.9	3.4	4.7	0.279	0.0290
	Vits .B_1+B_6	0.6	1.2	1.6	2.0	3.0	0.212	0.0251
Average		0.9	1.7	2.5	3.3	4.8	0.271	0.0293
L.S.D. 5% between: IBA (I) = 0.03							0.002	0.0001
Co- factors (C) = 0.03							0.004	0.0003
Period (P) = 0.03							---	---
I*C = 0.05							0.005	0.0003
I*P = 0.05								
C*P = 0.06								
I*C*P = 0.09								

Average of one root length and the total root lengths per one cuttings (Table, 67)

As a general, individual root length was affected by the different treatments, as different treatments stimulated the length of one root. In addition, as the total root lengthes were got from the multiplication of root length and the number of the formed roots per one cuttings, hence, all of the treatments enhanced the total root lengthes per one cutting, i.e. the total absorb organ in cutting, which reflected its effect on the growth behaviour of the developing cuttings. The highest total root lengthes was gained by catechol plus IBA, while the lowest stimulatory effect was gained by IBA plus vits. $B_1 + B_6$. Again, the response of the cuttings to the applications of different treatments was quite different from one species to another, as compared to those reported by ***Scindapsus aureus.***

Percentage increase of fresh weight as related to start sample (Table, 68)

The percentage increase of fresh weight was increased with advancing age till it reached the maximum at the end of water culture incubation. The maximum rate of percentage increase was gained by 0.2 ppm IBA + catechol at 0.5 ppm. In addition, all of the treatments stimulated the higher proportion rate of fresh weight increments over the control treated cuttings during different periods of incubations. This may indicate that the stimulatory effect of different treatments was extended to include the rate of fresh weight increment. The complete success of cuttings by using 0.2 ppm IBA plus catechol was extended to include the highest proportion rate of fresh weight increment, i.e. more developed cuttings. The more developed cuttings were also obtained by all other treatments when compared with control treated plants, but with less rates when compared with catechol plus IBA.

Percentage increase of dry weight as related to start sample (Table, 69)

It could be stated that similar trend seemed to be observed as mentioned before in percentage increase in fresh weight, as it may conclude. That catechol synergized the stimulatory effect of IBA on the accumulation of dry weight in ***Philodendron scandens*** developing cuttings. It must be mentioned that coumarin either alone or in combination with IBA, the growth inhibitor, exhibited the less stimulatory effect on dry weight increase percentage as compared to any other treatment.

Table (67): Combined effect of IBA and some co-factors on the formed root length(per one root and the total root lengthes per one cutting of *Philodendron scandens* during different periods of water culture incubation (days of incubations).

IBA (ppm)	Co- factor (0.5 ppm)	Root length cm/per one root				Total root length / one cutting (cm)			
		14	21	28	35	14	21	28	35
0.0	Without	1.40	1.60	2.10	3.20	0.70	0.96	1.89	2.88
	Catechol	2.70	2.90	3.40	3.70	1.89	5.51	8.50	13.00
	Pyrogallol	2.20	2.50	2.70	3.40	1.32	4.75	7.83	13.26
	Coumarin	2.30	2.80	2.50	4.40	5.52	9.80	11.25	21.56
	Vits B_1 +B_6	2.90	3.10	3.10	3.40	7.83	11.16	17.67	23.12
Average		2.50	2.80	2.90	3.70	4.14	7.81	11.31	17.74
0.2	Without	2.20	2.70	3.10	3.90	1.32	2.16	9.61	15.21
	Catechol	1.90	3.00	4.00	3.90	4.75	14.04	19.6	30.81
	Pyrogallol	2.60	4.80	5.00	4.20	3.12	9.12	14.00	14.28
	Coumarin	4.60	4.30	4.20	4.00	7.82	12.47	14.28	18.80
	Vits .B_1+B_6	2.90	4.20	5.10	3.70	3.48	6.72	10.20	11.10
Average		3.00	4.10	4.60	4.00	4.79	10.59	14.52	18.75

Table (68): Combined effect of IBA and some co-factors on the percentage increase of fresh weight as related to start sample during different periods of water culture incubations of *Philodendron scandens*.

IBA (ppm)	Co- factor (0.5 ppm)	Days of incubations				
		7	14	21	28	35
0.0	Without	11.8	11.9	12.0	12.2	16.3
	Catechol	12.7	14.0	14.1	17.4	26.0
	Pyrogallol	7.2	9.5	17.6	34.9	39.0
	Coumarin	10.9	11.9	14.3	19.4	22.8
	Vits B_1 +B_6	11.1	19.0	21.9	23.8	36.9
Average		10.5	13.6	17.0	23.9	31.2
0.2	Without	16.6	18.2	18.9	23.3	32.9
	Catechol	13.6	22.1	22.7	23.7	43.1
	Pyrogallol	6.3	9.0	10.5	38.9	39.4
	Coumarin	6.2	6.8	7.9	10.7	22.0
	Vits .B_1+B_6	6.1	23.4	27.4	27.8	32.9
Average		8.1	15.3	17.1	25.3	34.4

(69): Combined effect of IBA and some co-factors on the percentage increase of dry matter of *Philadendron scandens* cuttings, during different periods of water culture incubations.

IBA (ppm)	Co- factor (0.5 ppm)	Days of incubations				
		7	14	21	28	35
0.0	Without	11.3	12.0	12.2	12.4	16.3
	Catechol	12.6	14.1	14.3	19.0	26.5
	Pyrogallol	7.4	9.6	17.9	31.5	39.3
	Coumarin	10.9	11.9	14.3	19.4	24.5
	Vits B_1 +B_6	11.2	19.2	21.8	34.0	36.9
	Average	10.5	13.6	17.1	26.0	31.8
0.2	Without	16.6	18.2	19.1	23.5	32.9
	Catechol	13.6	22.5	22.9	31.8	43.9
	Pyrogallol	6.7	9.8	14.9	39.0	38.4
	Coumarin	6.2	7.8	9.8	14.9	24.0
	Vits B_1 +B_6	10.1	23.4	27.3	29.7	37.5
	Average	9.2	15.9	18.7	28.9	36.0

Concentration of some nutrients (Table, 70)

It may conclude that K is the dominant element in ***Philodendron scandens,*** under the conditions of this experiment of water culture incubations, followed by Ca, N, P, Mg, Fe, Mn, Zn, and Cu ranked the last in this respect. Potassium proportion seemed to be about 2.5 times of Ca, as a general, and about 2.9 times of N. Iron proportion seemed to be more than four times of Mn, while Mn was about 6.25 times of Zn, but Ze seemed to be more than 2.8 times of Cu.

Different treatments controlled the accumulation of different nutrients in the developing cuttings of ***Philodendron scandens***. Their effects were extended to the balance between different nutrients. Accordingly, it may conclude that co-factors and IBA may affect the absorption of the different nutrients.

New formed leaves during pot culture periods (Table, 71)

All of treatments stimulated the leaf formation during different periods of pot phase culture which extended into 16 weeks after re-transplanted the developing cuttings. The highest number of new formed leaves was obtained by coumarin + IBA, while the lowest stimulatory effect in this respect was obtained by coumarin alone. The stimulatory effect of the different treatments on leaves formation seemed to be through the early stimulatory effects on different growth criteria during water culture phase, i.e. the stimulatory effect during water culture period was extended during pot culture phase.

Stem length during pot culture phase (Table, 72)

Stem length during pot culture phase increased with the same variance by the treatments under the conditions of this experiment. It was concluded that the stimulatory effects of different treatments during water culture phase were extended into pot culture phase.

Experiment III B.d.:

Combined Effect of IBA and vits. B_1 + B_6 on Rooting Ability of Scindapsus aureus Cuttings and The Changes in Some Organic compounds

As it was mentioned before, many exogenous factors affecting the rooting ability of ***Scindapsus aureus*** cuttings, which include type (IBA at very low rate - 0.2 ppm) and some

Table (70): Combined effect of IBA and some co-factors on the concentration of some nutrients of *Philodendron scandens* cuttings, at the end of water culture incubation.

IBA (ppm)	Co- factor (0.5 ppm)	mg-/gr. dry weight								
		N	P	K	Ca	Mg	Fe	Mn	Zn	Cu
0.0	Without	25.4	1.17	70.1	35.77	1.167	863.4	229.7	22.5	9.3
	Catechol	27.3	1.35	71.4	35.71	1.271	797.3	205.8	31.4	8.9
	Pyrogallol	28.2	1.88	76.7	35.23	1.192	931.7	302.5	33.5	9.9
	Coumarin	28.9	1.35	60.1	29.51	1.177	835.7	191.5	30.0	7.2
	Vits B_1 +B_6	29.3	1.52	80.2	35.72	1.291	997.2	202.1	37.9	14.5
	Average	28.4	1.53	72.10	34.04	1.345	890.5	225.5	33.2	10.1
0.2	Without	36.7	1.73	50.31	36.71	1.417	710.6	219.3	17.9	16.4
	Catechol	21.9	1.93	75.30	29.44	1.839	999.8	280.6	51.2	9.9
	Pyrogallol	19.8	1.97	77.40	26.15	1.714	816.4	260.4	60.7	10.8
	Coumarin	25.5	1.74	75.81	20.32	1.952	620.9	199.9	19.9	23.5
	Vits .B_1+B_6	24.6	1.56	75.31	27.18	1.831	833.4	180.7	30.5	21.9
	Average	23.0	1.80	75.96	25.77	1.834	817.6	230.4	40.6	16.5

Table (71): Combined effect of IBA and some co-factors on the number of new formed leaves of *Philodendron scandens* plants during different periods of growth under pot culture conditions.

IBA (ppm)	Co- factor (0.5 ppm)	Weeks under pot culture conditions							
		2	4	6	8	10	12	14	16
0.0	Without	1.1	1.7	3.5	5.7	10.4	16.7	20.1	25.7
	Catechol	2.5	3.8	5.7	8.9	14.5	20.9	24.9	33.5
	Pyrogallol	2.5	3.7	5.9	9.3	16.1	23.5	27.1	34.4
	Coumarin	2.4	3.9	5.1	8.4	15.3	20.1	23.4	30.5
	Vits B_1+B_6	2.4	4.9	6.7	11.5	17.5	25.7	31.5	37.9
	Average	2.5	4.1	5.9	9.5	15.9	22.6	26.7	34.1
0.2	Without	2.2	4.8	6.1	10.7	14.6	19.8	25.7	30.1
	Catechol	2.9	4.8	7.1	11.4	19.8	23.7	27.9	34.5
	Pyrogallol	2.7	4.9	8.1	11.5	20.9	25.7	30.3	35.7
	Coumarin	2.9	5.2	7.0	14.7	25.1	30.4	31.9	39.8
	Vits B_1+B_6	2.8	4.7	6.5	10.5	14.8	25.6	29.4	33.5
	Average	2.8	4.9	7.2	12.0	20.2	26.4	29.9	35.9

L.S.D.5% between: IBA (I) =0.1
Cofactors(C) =0.2
periods (P) =0.4
I*C =0.6
I*P =0.9
C*P =0.0
I*C*P =1.4

Table (72): Combined effect of IBA and some co-factors on the stem length of *Philodendron scandens* plants during different periods of growth under pot culture conditions (cm/plant).

IBA (ppm)	Co- factor (0.5 ppm)	Weeks under pot culture conditions							
		2	4	6	6	10	12	14	16
0.0	Without	1.9	2.9	5.4	9.9	11.6	16.9	20.5	25.3
	Catechol	2.4	4.3	6.9	11.5	14.9	19.1	25.3	29.3
	Pyrogallol	3.8	4.9	7.1	11.4	14.7	19.6	26.2	29.4
	Coumarin	2.9	4.1	8.1	10.3	13.1	18.1	23.5	28.9
	Vits B_1+B_6	3.4	4.2	8.3	12.4	15.2	22.4	26.4	33.2
	Average	3.1	4.4	7.6	11.4	14.5	19.8	25.4	30.2
0.2	Without	2.0	3.8	6.7	10.9	13.9	18.3	23.1	30.6
	Catechol	2.8	4.4	7.9	11.8	15.6	20.2	26.1	31.4
	Pyrogallol	2.3	4.6	9.9	11.9	15.9	21.3	27.1	32.7
	Coumarin	2.5	4.7	9.3	11.4	14.4	20.1	24.5	31.8
	Vits B_1+B_6	2.1	4.2	8.6	13.5	17.6	23.2	29.1	37.9
	Average	2.4	4.5	8.9	12.2	15.9	21.2	26.7	33.5

L.S.D.5% between: IBA (I) =0.2
Co-factor (C) =0.3
periods (P) =0.5
I*C =0.7
I*P =0.8
C*P =0.9
I*C*P =1.4

co-factors especially auxin of B_1+B_6 (0.25 + 0.25 ppm rom both), as the best result was gained by the forementioned treatments. Again, doublet exogenous applications of either IBA or co-facotrs modify plant growth either directly or indlirectly throughout endogenous phytohormone level and the balance between growth promoters and growth inhibitors, especially (ABA) abscisic acid. The effect of different treatments with IBA or co-factors on plant growth behaviours seemed to be directly either on the biosynthesis of endogenous auxin (IBA) **(Gordon & Paleg, 1961 and Gorter, 1969),** or throughout their indirect effects as anti oxidates of IAA **(Tomaszewski & Thimann, 1966)** and many other workers.

In addition, the application of different growth factors may bring a wide range of possibilities exploring complicated physiological phenomena such as the success of cuttings. It was concluded by many workers that the major internal factor affecting root initiation in cuttings is related to the endogenous auxins, mainly IAA **(Hess, 1963; Odom & Carpenter, 1965; Machida & Fujii, 1967; Preziosi, 1967; Stoltz, 1968; Devlin, 1975 and Devlin & Witham, 1983).**

In addition, it was postulated that there was an apparent parallel correlation between "abscisic acid in cutting tissues of many plant species and their un-success **(Heide, 1965; Patan, *et al.*, 1970 and Tognoni, *et al.*, 1977).** Moreover, **Donho *et al.* (1962)** demonstrated that rooting substance is a complex structure of high molecular weight and possibly is a product from condensation between the applied auxin and the phenolic substances produced by the buds or the attached leaves. Thus, it was stated by many workers that external or internal phenolic compounds affected the rooting ability of many plant species cuttings (see the review of literature).

According to the formentioned information, it was thought advisable to extend this study to include the balance between IAA and abscisic acid (ABA), i.e. between endogenous promoter and endogenous inhibitor, as well as free, bound and total phenolic compounds, as related to the treatments without or with the presence of IBA at the rate mixure of vits B_1+B_6 (0.25 + 0.25 ppm from both on ***Scindapsus aureus*** cuttings incubated under Hewitt's nutrient solution for only eight days.

Effect of different treatments on some growth critaria Table (73)

It may be concluded the following conclusions:

(a) The highest rooting ability was gained by the combined treatment with IBA at the rate of 0.2 ppm + mixture of vits. $B_1 + B_6$, as it was estimated the very minute emerged roots as rooted cutting, early stage of root initiation)

(b) The same conclusions were also demonstrated in other growth critaria, i.e. No. of roots/one cutting, root length/one root, total root lengths/one cutting, fresh weight/one cuttings and percentage increase as related to start sample, with relatively daily rate of percentage increment.

The changes in free, bound and total phenolic compounds in the cuttings tissues as related to different treatment Table (74)

It may conclude the following:

(a) Free phenolic compounds were less than the bound ones in ***Scindapsus aureus*** cutting, before or after incubation.

(b) Free or bound phenolic compoundes increased after the eight days of incubation, reached the maximum by the absence of any external application, i.e. control cuttings (in leaf blade while it were mostly increased in stem with the attached leaf petiole, and that may indicate that some of phenolic compounds may from leaf blade into stem.

(c) Phenolic compounds are higher in leaf blade than stem.

(d) Different treatments controls and regulates the balance between free and bound phenolic componuds.

The changes in Chloroplast Pigments as related to different treatments (Table (75).

It may concluded the following:

(a) Leaf blade possesed higher concentration of chloroplast pigments than leaf petiol plus stem differnt treatments stimulated higher accumulation of different chloroplast pigments as related to start sample (before incubation) in mother leaf blade or leaf petiole.

(b) The highest pigments was observed in cuttings treated with 0.2 ppm IBA + 0.5 mixture $B_1 + B_6$.

.e (73): Effect of 0.2 ppm IBA alone or in combination with vits. $B_1 + B_6$ coumarin on some growth critaria of ***Scindapsus aureus*** cutting incubated for eight days under water culture conditions.

* eatment	% of rooted / cuttings	No.of root/one cutting	Rootleng-th/one root (cm)	Total root lengthes/ one cutting (cm)	Fresh weight/one cutting			
					Before incubation start sam.	After 8 days of incubation	%increase after 8days as related to start sam.	Daily rate of% increase
I	45	0.60	0.33	0.25	2.55	2.89	13.3	1.66
II	80	1.10	0.45	0.50	2.54	2.85	12.2	1.53
III	90	1.45	1.94	2.81	2.52	2.91	15.5	1.94

: (74): Effect of 0.2 ppm IBA alone or in combination with vits. $B_1 + B_6$ coumarin on the concentration of free bound and total endogenous phenolic compounds (µg/gr. fresh weight) of ***Scindapsus aureus*** cutting incubated for eight days under water culture conditions.

* ient	leaf blade (mg./gr fresh weight)			stem+leaf petiol(mg/gr fresh weight)			% as related to total (leaf blade)		%as relatedtototal (stem+leaf patiol)		Totalle-afblade/ total of stem+le-afpetiol
	Free	baund	Total	Free	Baund	Total	Free	Baund	Free	Baund	
e inc n(st-ampl)	70	92	162	66	72	138	43.2	56.8	47.8	52.2	1.17
	124	154	278	39	86	125	44.6	55.4	31.2	68.9	2.22
	87	116	203	60	105	165	42.9	57.1	36.4	63.6	1.23
II	100	105	205	62	120	182	48.8	51.2	34.1	65.9	1.13

Table (75): Effect of 0.2 ppm IBA alone or in combination with vits. $B_1 + B_6$ coumarin on the concentration of chloraplast pigments (µg/gr. fresh weight) of ***Scindapsus aureus*** cutting incubated for eight days 5.

Treatment	leaf blade(mg./gr.fresh weight						leaf petiol+stem(mg/gr.freshweigh					
	ch.a	ch.b	chs a+b	chs a/b	car.	chs a+b /car	ch.a	ch.b	chs a+b	chs. a/b	car.	chs.a+b car.
Before incubation (start sam	450	220	670	2.04	200	3.35	38	21	54	1.571	30	1.8
I	550	250	800	2.20	200	4.00	64	49	113	1.306	52	2.17
II	520	220	740	2.36	230	3.22	40	35	75	1.143	27	2.78
III	610	280	890	2.17	260	3.42	80	66	146	1.212	45	3.24

Treatment I= Control (1/4 Hewitt's Solution) - Treatmant II=0.2 ppm IBA (1/4 Hewitt's solution) - Treatment III=0.2ppm IBA+0.5ppm vits B1+B6 (1/4 Hewitt's solution).

(c) It may be concluded that the highest percentage with the rooted cuttinges by combined with IBA + vit.B was correlated to the higher stimulatory effect on different chloroplast pigments over any other treatments in either leaf blade or leaf petiol + stem.

(d) Different treatments regulated the balance between different fraction of chloroplast pigments proportion blance either in leaf blade or leaf petiol + stem.

(e) Chlorophyll a, mostly, seemed to be more twice chlorophyll b in leaf blade and less than twice in leaf petiole + leaf stem.

(f) Ratio of the chlorophyll a + b seem to be mostly three times of carotenoids in leaf blade while great variable in such ratio in leaf petiole + stem by different treatments.

(g) It may be concluded that different treatments controled and regulated the bio-synthesis of chloroplast pigment in ***Scindapsus areus*** mother leaf under the conditions of this experiment.

Effect of IBA alone or in combination with vits. B_1 + B_6 on the concentration of endogenous IAA and ABA in the erly developed Scindapsus aureus cuttings (Table, 76):

It may conclude the following:

a) Endogenous IAA was in its lowest amount in the tissues of the start using cutting of ***Scindapsus aureus***, as compared to those corresponding ones which incubated for eight days; i.e. the developed cuttings.

b) With regards to the effect of incubation under different treatments, it may conclude that IBA at the rate of 0.2 ppm alone stimulated greatly in higher formation and accumulation of IAA, while such treatment depressed greatly the formation and accumulation of ABA. In other words, the formation of IAA under such treatment was more than three times of that found in the start sample (before incubation, while ABA, the growth inhibitor was less than found in start sample by about 85%, i.e. the ratio of IAA, the growth promoter, as related to the growth inhibitor (ABA) was about 6.2 times. This means that, the presence of IBA in the medium of ***Scindapsus aureus*** at the rate of 0.2 ppm regalated the formation of IAA to be exceeded with about more six times of ABA, as such treatment seemed to decline and degenerate the amount of ABA which already present in the mother cuttings of ***Scindapsus aureus*** till it reached the lowest value. It must be

nentioned that, the complete success of ***Scindapsus aureus*** cuttings by the presence of 0.2 ppm. IBA in the culture medium, seemed to be mostly related to its effect on the ratio between endogenous growth promoter (IAA), to the endogenous growth inhibitor (ABA), in addition to its effect on the high formation of IAA and its effect on the degeneration of ABA.

In addition, the complete success of ***Scindapsus aureus*** cuttings under the presence of 0.2 ppm IBA plus vits. B_1 + B_6 seemed to be associated with less relative increase of IAA and relatively the less amount of ABA. However, the ratio of IAA/ABA was less as related to such found in the treated cuttings with 0.2 ppm IBA alone. This means that vits. B_1 + B_6 regulated the formation of IAA and ABA.

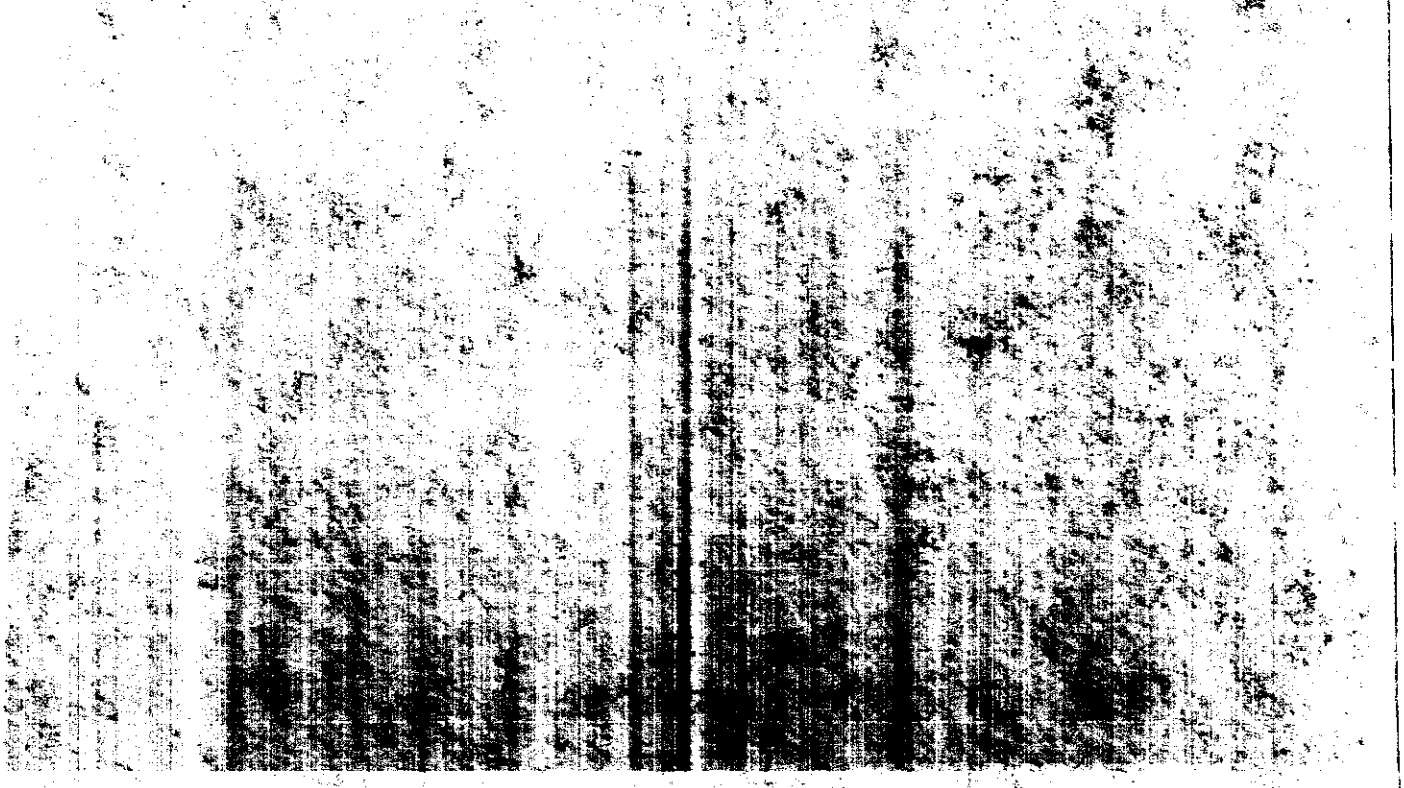
It must be mentioned that the study must be extended to found a correlation between the exogenous application of growth co-factors and endogenous changes in all co-growth factors with the changes in the success of cuttings, if the question is to be fully answered.

(76): Effect of 0.2 ppm IBA alone or in combination with vits. B_1 + B_6 on the concentration of endogenous IAA and ABA (µg/gr. fresh weight) of ***Scindapsus aureus*** cutting tissues incubated for eight days under water culture conditions.

* Treatment	µg/gr.fresh weight		% increase or decrease as related to start sample		Ratio of IAA/ABA
	IAA	ABA	IAA	ABA	
Before incubation (start sample)	42.385	192.660	-	-	0.220
I	96.923	207.692	+128.67	+07.80	0.467
II	178.738	29.056	+321.70	-84.92	6.162
III	64.800	89.000	+52.88	-53.81	0.728

*Treatment I = Control-Treatment II = 0.2 ppm IBA-Treatment III = 0.2 ppm IBA + 0.5 ppm mixture of vits. B_1 + B_6. All treatments usder the conditions of 1/4 Hewitt's nutrient solution.

CONCLUSION AND RECOMMENDATIONS



CONCLUSION AND RECOMMENDATIONS

Since the down of agriculture, one of man's prencipal aims has been the control of plant growth and its propagation. The growth behaviour of those plants propagated mainly by vegetative portion, as in ***Araceae*** plants, is very important, as the higher the number of shoot system formation, the higher stem cuttings number are gained. The growth behaviour, as a general, depends on the seasonal fluctuation of the growth activity, which is controlled by the prevailing enivronmental factors, as the net gain of plant growth is an expression of the external and internal factors. In addition, many plant species, like different species of ***Araceae*** plants, fail to flowering and to produce seeds under cultivation conditions, thus the study and improving their vegetative propagation are very important.

A lot of "arum" numbers are used as very valuable indoor decorative plants, and are widely used, mainly for their showy foliage, throughout the worled. ***Scindapsus aureus, Philodendron scandens, Philodendron bipinnatifidum*** and ***Philodendron erubesens*** are widely used on a large scale as indoor decorative plants all over the worled. It is threfore, essential that efforts should be constantly made to study their growth behaviours which control their vegetative propagation and trying to improve such propagation itself. During the past few decades a lot of studies were carried out on the "aroids" by horticulturists dealing with practices application. However, efforts dealing with botanical and physiological studies are not attracting the Botaniestes or physiologists till now. Thus, very little and rare information are known about their growth behaviour.

From our observation, the four tested species showed complete and very strong apical dominance phenomenon, as the main axis grew solitary without any lateral branch formation. It is also concluded that, the removal of apical bud permits the growth activity of only one axillary bud, the most nearest one to the disapical portion, of the four tested species.

The morphogenisis and seasonal changes in growth behaviour were also studied in details in the four tested species under different methods of their grown conditions, as ***Scindapsus aureus,*** and ***Philodendron scandens***, were used either as vine vertical climbing

on supports, peding under hanging pots, or like creeping or running horizontally on tables. Two types of roots were formed in ***Scindapsus aureus*** only, and defined them as "aerial climber internoded rootlets" and "noded aerial functional roots". These types of roots are differed according to the method of growing. However, in ***Philodendron*** three species only one type of roots was observed the "tendrl nodded aerial climber one". In addition, great variation in stems and leaves growth behaviour occured in the four tested species. However, it may be concluded as a general, that the four tested plant species exhibit "***thigmomorphogenesis***" with the response of many sensous agents, such as the hight direction, adjacent surface bodies and/or gravity (gravimorphism), as they exerted variable morphogenesis in response to different external stimulus agents. It was supposed that much work must be done in this phenomenon if the question is to be fully answered, as the success of such plants under the comman conditions of the users depends upon such phenomenon.

From our observations, it could be concluded that, growth pattern and shoot organization in ***Scindapsus aureus*** under cultivation conditions is from the monopodial proleptic type, while in the three tested ***Philodendron*** species are from sympodial sylleptic type. These facts are very important for the vegetative propagation success.

It could be concluded from this study that the rate of growth in the tested four species began at relatively low, during February and increased gradually after that till they reached the maximum during August and declined again till reached into nill during January, as the different plant species enter into dormant state under cold stress conditions without any growth activity. Thus, it was recommended that cuttings could be collected during allover the year except during dormant state of the coldest season, but with variable numbers according to the rate of growth activity.

Again all of the four tested plant species exhibitd complete and very strong apical dominance phenomenon as all of the axillary buds are in complete dormant or rest state. For stimulation lateral branch formation, two experiments were carried out, the first including the application of GA_3 by using direct application on the axillary buds of ***Scindapsus aureus*** by means of moisted absorbed cotton in the presence or absence of terminal bud at

the rate of 0.0, 1, 2 or 4 ppm. It was suggested and recommended that direct application of 4 ppm. in the absence of terminal bud gave the most effective rate on the breakdown of apical dominance, as the highest lateral branches were formed. Prophyll and the cataphyll or reduced leaves appeared at first on the formed branches, then there is a gradual transition from the smallest and reduced leaves to the normal photosynthetic complete leaves. This phenomenon is not found under normal growth conditions in ***Scindapsus aureus.*** It must be mentioned, that the presence of apical bud, retareds partially the stimulatory effect of GA_3 on branch formation. It was defined the cataphylls or reduced leaves which follow under GA_3 treated plants as "proleptic mesophylls".

The results of the second experiment dealing with breakdown of apical dominance include different four tested plant species and the method of growth regulater application was the foliar method at the rate of 100 of both GA_3 or BA, while PP_{333} was used at the rate of 5ppm beside the control treamtent. The obtained results indicate that different treatments seemed to have partial and very weak effects on the breakdown of apical dominance in the four tested plant species, as the number of different formed branches was very low, and not developed into functional branches. As a general, apical dominance is a complecated physiological phenomenon. From the bulk of literature apical dominance seemed to be an expression by a delicate balance between phytohormenes, i.e. auxins gibherellins and cytokinins. On this basis, it was suggested that exogenous application of GA_3 at the rate of 4 ppm on the decapitated ***Scindapsus aureus*** may regulate such balance leading to the more release of functional lateral branche formation. However, the applications of 100 ppm GA_3 or BA alone on the four tested plant species in the presence of apical bud seemed to have the lowest effect on the regulation of apical deminance and lateral branch formation. Regulating apical dominance phenomenon is very important in ***Araceae*** plant, as the increase in shoot growth help used to collect higher amounts of cuttings for vegetative propagation. The normal use of cuttings in ***Scindapsus aureus*** and ***Philodendron scandens*** by the growers are those contain more than one nodes and the terminal one and cultivated under green house with mist. This method of cultivation the cuttings is very expensive, thus the price of such decorative plants is very high. In addition,

few number of cuttings are collected. Accordingly, this study modifies the method of cultivation of cuttings by using singl leafy node stem cuttings, cultivated in water culture medium and subjected them under normal environmental condition of laboratory.

The advantages of this method comes from the fact that large amounts of cuttings could be cultivated without any high expenses by using mist, as our tested plants may be considered as hydrophytic plants.

As it was mentioned by many investigators, many factors affected rooting ability of ***Scindapsus aureus*** and ***Philodendron scandens*** cuttings. Accordingly, it must carry out a series of experiments to solve every factor alone at first during preliminary studies, then detail studies must be completed after that to get some clue information about the rooting process itself.

From this results, it could be recommended the following:

a) To get the highest percentage of rooted cuttings 1/4 Hewitt's nutrient solution is the best water culture medium strength.

b) To get the highest percentage of rooted cuttings, the collection of cuttings must be taken from June till August. However, it may be reccommended to collect the cuttings during all the year except during December till February, as the cuttings fail to rooting during their dormant stage under cold stress. Thus, it was suggested that the time of the year during which the cuttings are taken is considered as one of the more important factors affecting rooting ability, as internal and external factors are responsible of rooting ability and root production itself.

c) Node possition, i.e. cuttings age seemed to have any effect on their rooting ability of ***Scindapsus aureus*** and ***Philodendron scandens***.

d) In spite of the large use of IBA and NAA as rooting agents in a lot of plant species with relatively high concentration, only five ppm. of IBA or NAA applied in water culture medium for seven days produced many undesirable harmoful effect on roots shape and thier formation. This deformed root shape was superiour by using NAA at 5 ppm or more. The higher the rate of IBA or NAA, the higher the rate of deformed roots were gained. Thus our study was extended to use a very low concentrations of IBA (0.1 or 0.2

ppm). BA was used by many workers as rooting agent. It was found that incubation of ***Scindapsus aureus*** and ***Philodendron scandens*** for seven days under water culture conditions of 1/4 Hewitt's nutrient solution containing 0.2 ppm IBA produced the highest percentage of rooted cuttings. In addition, BA stimulated rooting ability in both tested plant species when used at the rate of 5 ppm, but the superiour effect was gained by IBA either at the rate of 0.1 or 0.2 ppm. However, the use of IBA as external rooting agent is not the only agent, as many external application agents gave the best results such as many phenolic compounds such as pyrogaloll, catecholl and mixture of vits. $B_1 + B_6$. On other hand, the application of GA_3 retarded the rooting ability of ***Scindapsus aureus*** cutting when applied at a very low rate (5 ppm).

Rooting ability processes seemed to be very complicated physiological phenomenon, as many external and enternal factors judjing and control such processes. From our biochemical and physiological studies some assumption may be related to such complicated phenomenon. Form our results dealing with many chemical analysis, it may revealed that different nutrients uptakes, carboluydrate metabolism, amino acid biosynthesis, endogenous phenolic compounds synthesis, and the rate of free IAA and ABA formation, all contributed in rooting processes. It is also suggested from our study that the balance between organic compounds as well as between nutrient elements is very important in controlling rooting ability in ***Scindapsus aureus.***

It may reveal that additional work must be continued if the question is to be fully answered.